THE

POPULAR SCIENCE MONTHLY.

APRIL, 1890.

SCIENCE IN THE HIGH SCHOOL.*

By Prof. DAVID STARR JORDAN,

PRESIDENT OF THE UNIVERSITY OF INDIANA.

THE purpose of science-teaching as a part of general education is this—to train the judgment through its exercise on first-hand knowledge. The student of science is taught to know what he knows and to distinguish it from what he merely remembers or imagines. Our contact with the universe is expressed in what we call science. Throughout the ages, the growth of the human mind has been in direct proportion to the breadth of this contact. To the man without knowledge of science, the universe seems small. Science is our perception of realities; and as the realities come year by year to occupy a larger and larger place in our life, so the demand for more and better training in science will long be an urgent and growing one. But science should hold its place in the schools by virtue of its power as an agent in mental training, not because of the special usefulness of scientific facts, nor because knowledge of things has a higher market value than the knowledge of words.

The time will come when the study of the objects and forces of nature will be as much a matter of course in all our schools as the study of numbers, but the science-work of the next century will not be the work we are doing now. The science in our schools is too often a make-believe, and the schools will lose nothing when every make-believe slips out of the curriculum. Deeply as I am interested in the progress of science, both in school and out, with Prof. Huxley "I would not turn my hand over" to have biology taught in every school in the land, if the subject is taught through books only. To pretend to do, without doing, is worse

* Read before the Indiana State Teachers' Association, December 26, 1889.

than not to pretend. The conventional "fourteen weeks" in science gives no contact with nature, no training of any sort, no information worth having; only a distaste for that class of scattering information which is supposed to be science.

There is a charm in real knowledge which every student feels. The magnet attracts iron, to be sure, to the student who has learned the fact from a book, but the fact is real only to the student who has himself felt it pull. It is more than this, it is enchanting to the student who has discovered the fact for himself. To read a statement of the fact gives knowledge, more or less complete as the book is accurate or the memory retentive. To verify the fact gives training; to discover it gives inspiration. Training and inspiration, not the facts themselves, are the justification of science-teaching. Facts enough we can gather later in life when we are too old to be trained or inspired.

What is true of one science is true of all in greater or less degree; and I may take the science of zoölogy for my illustration simply because it is the one nearest my hand. In very few of our high schools has the instruction in zoölogy any real value. For this unfortunate fact there are several causes, and some of these are beyond the control of the teachers. In the first place, the high-school course is overloaded, and the small part of the course given to the sciences is divided among too many of them. A smattering of one science is of little value, either for discipline or information. A smattering of many sciences may be even worse, because it leads the mind to be content with smattering. Indeed, so greatly have our schools sinned in this respect that many writers on education seem to regard science as synonymous with smattering, and they contrast it with other branches of learning, which are supposed to have some standard of thoroughness. Most of our colleges have, at one time or other, arranged courses of study not approved by the faculty, in response to the popular demand for many studies in a little time. Such a course of odds and ends is always called "the scientific course," and it leads to the appropriate degree of "B. S."—Bachelor of Surfaces.

The high school can do some things very well, but it will fail if it tries to do too much. Unfortunately, the present tendency in our high schools is in the direction of such failure—to do many things poorly rather than a few things well. Each high school aims to give a general education; to be a university in a small way—a university for the poor—a poor university. In the words of Lowell, "The public schools teach too little or too much; too little, if education is to go no further; too many things, if what is taught is taught thoroughly. And the more they seem to teach, the less likely is education to go further; for it is one of the weaknesses of democracy to be satisfied with the second best, if it

appear to answer the purpose tolerably well and is cheaper, which it never is in the long run." In other words, we try to satisfy the public by a show of teaching those subjects which we can not really teach. And so, in the sciences we study books instead of Nature, because books are plenty and cheap, and can be finished quickly, while Nature herself is accessible only to those who want something of her.

The high school would do well not to attempt to give a general view of science. This is possible only in a "Chautauqua course" or in a "school of all sciences." It is better to select some two or three of the number, a physical and a biological science, perhaps, and to spend the available time on these. The choice should depend mainly on the interest or the skill of the teacher. Teach those sciences that you can teach best.

President Hill, of Rochester University, has well said: "Thousands of our youth have studied chemistry without ever seeing an experiment, physics without seeing an air-pump, and astronomy without ever looking through a telescope. A professor of the ancient type maintained that this is a great advantage, like the study of geometry without figures, because it stimulates the imagination. It is an invigoration of stupidity and conceit, sealing the mind to reality by substituting subjective fancies for experimental proofs, and the pretense of knowing for clear ideas. Its effect upon the morals is as pernicious as its effect upon the mind, for it weakens the reverence for truth and engenders the habit of mental trifling."

Even so wise a schoolmaster as Dr. William T. Harris excludes science-teaching (and science-teaching with him means simply giving information about scientific subjects) from the fundamental requirements of education, because the knowledge of nature is not one of the five windows through which the soul looks out on life. These windows, according to Mr. Harris, are reading and writing, grammar, arithmetic, geography, and history. The simile is a happy one. The soul, confined in the watch-tower of mediæval education, looks out on the world through these five windows, and they are but windows, for they give no contact with the things themselves. The study of nature throws wide open the doors, and lets the soul out to the fields and woods. It brings that contact with God through his works which has been, through all the ages, the inspiration of the poets and prophets, as well as of those long-despised apostles of truth whom we call men of science.

A second difficulty is this: Our towns will not pay for teachers enough to do the work as it should be done, and of the few teachers we have the people make no demand for thorough preparation. Very few of them are broadly educated or have had any

scientific training whatever. And such teachers are expected to teach a dozen subjects each, and therefore have no time to make good their defective preparation. Thus good teaching of science can not be expected, for streams do not rise higher than their sources. The only remedy for these conditions seems to lie in the gradual education of the people. A series of object-lessons, showing the difference between a good teacher and a poor one, is the most effective means of causing good work to be appreciated.

But taking things as they are, even with uneducated teachers and teachers crowded for time, fairly good work may be done by the use of good methods. A great deal will depend, not on the kind of books you use, but on the kind of books you avoid. Most of the current text-books of elementary zoölogy are simply pernicious so far as your purposes are concerned. Even if these books were well digested and accurate in their statements of fact, which is rarely the case, they are based on incorrect principles. They are not elementary but fragmentary in their character. It is a great mistake to suppose that, because a book is small and says very little about each one of the animals of which it treats, it is thereby rendered elementary. Fragments are not necessarily elements. A fragment of rock is as hard to digest as a bowlder. Elementary work in science should treat of but few things, but the impressions it leaves with the child should be very clear ones. The ideas derived from the common text-books are of the vaguest possible character. These books are the parasites, not the allies, of science. They bear the same relation to the progress of science that barnacles bear to the progress of a ship. If you keep clear of these, you can not go far astray. Let us recall the words of Agassiz to the publisher who tried to induce him to write a school-book on zoölogy:

"I told him," he said, "that I was not the man to do that sort of thing; and I told him, too, that the less of that sort of thing which is done the better. It is not school-books we want, but students. The book of nature is always open, and all I can do or say shall be to lead students to study that book; and not to pin their faith to any other." And at another time he said, "If we study Nature in books, when we go out of doors we can not find her."

The essential of method is that we allow nothing to come between the student and the object which he studies. The book or chart or lecture which can be used in place of the real thing is the thing you should never use. Your students should see for themselves, and draw their own conclusions from what they see. When they have a groundwork of their own observations, other facts can be made known to them as a basis for advanced generalizations, for the right use of books is as important as their misuse is pernicious; but work of this sort belongs to the university rather

than to the high school. You do not wish to have your students tell you from memory the characters of the *Sauropsida* as distinguished from the *Ichthyopsida*. What you want is the answer to their own questionings of the frog and the turtle.

I was lately present at a high-school examination in zoölogy. The teacher gave a number of the stock questions, such as "Describe the Gasteropoda." "What are the chief differences between the domestic turkey and the turkey of Honduras?" "How do Asiatic and African elephants differ?" "On which foot of the ornithorhynchus does the webbing extend past the toes?" and so on. At last he said: "I will now give you a practical question: A few days ago we had a frog in the class, and all of you saw it; now write out all the characteristics of the sub-kingdom, class, and order to which the frog belongs."

This is all useless. The definitions of these classes and orders do not concern the child. To the working naturalist these names are as essential as the names of the stations on the road to a railway engineer. They belong to his business, but the names and distances of railway stations do not form part of any good work in primary geography. You do not need to teach your students that vertebrates are divided into mammals, birds, reptiles, batrachians, and fishes. It is not true in the first place, and, if it were, it is not relevant to them. Stick to your frog, if you are studying frogs, and he will teach you more of the science of animals than can be learned from all the memorized classifications that you can bracket out on a hundred rods of blackboard!

The prime defect in our schools is not, after all, that the teachers do not know the subjects they teach, but that they do not know nor care for the purpose of their teaching. In other words, they do not know how to teach. The book is placed in their hands by the school board, and they teach by the book. If the book comes to them wrong-side up, their teaching is forever inverted. That this is true, the statistics gathered last year from the high schools of Indiana, by Prof. Evermann, very clearly show. It is no wonder that a superintendent is needed for every dozen teachers. A good teacher should know the end for which he works, and then he can adapt his means to fit this end.

I once visited a large high school, one of the best in the country, with a science teacher whose studies have won him the respect of his fellow-workers. But for some reason, on that day at least, he failed to bring his own knowledge into the class-room. I heard him quizzing a class of boys and girls on animals—not on the animals of the woods and fields, not on the animals before them, for there were none, but on the edentates of South America. An especial point was to find out whether it is the nine-banded armadillo (*novemcinctus*) or the three-banded armadillo

(*tricinctus*) which does not dig a hole in the ground for its nest. The book, written by a man who did not know an armadillo from a mud-turtle, gives this piece of information. It was in the lesson, and the students must get it. And on this and like subjects these boys and girls were wasting their precious time—precious because, if they do not learn to observe in their youth, they will never learn, and the horizon of their lives will be always narrower and darker than it should have been. Already the work of that day is a blank. They have forgotten the nine-banded armadillo and the three-banded, and so has their teacher, and so have I. All that remains with them is a mild hatred of the armadillo and of the edentates in general, and a feeling of relief at being no longer under their baleful influence. But with this usually goes the determination never to study zoölogy again. And when these students later come to the college, they know no more of science and its methods than they did when at the age of one year they first cried for the moon.

Darwin tells us that his early instruction in geology was so "incredibly dull" that he came to the determination, afterward happily changed, "never so long as he lived to read a book on geology or in any way to study the subject."

I once had a student, well trained in the conventional methods of non-science, who was set to observe the yeast-plant under the microscope. He had read what the books say about yeast, and had looked at the pictures. So he went to work vigorously. In a short time he had found out all about the little plant, and had made a series of drawings which showed it very nicely. By and by some one noticed that he was working without any object-glass in his microscope. He had not seen the yeast-plant at all, only the dust on the eye-piece. This is the vital fault of much of our teaching of elementary science. It is not real; it is not the study of nature, only of the dust-heaps of old definitions.

Yet nothing is easier than to do fairly good teaching, even without special knowledge or special appliances. Bring out your specimens and set them before the boys and girls. They will do the work, and do it eagerly; and they will furnish the specimens too. There is no difficulty about materials. Our New World is the "El Dorado" of the naturalists of Europe. You can get materials for a week's work by turning over a single rotten log. I once heard Prof. Agassiz say to an assembly of teachers, and I quote from him the more freely because he gave his life to the task of the introduction of right methods into American schools:

"Select such subjects that your students can not walk out without seeing them. If you can find nothing better, take a house-fly or a cricket, and let each one hold a specimen while you speak. . . . There is no part of the country where, in the summer, you

can not get a sufficient supply of the best of specimens. Teach your pupils to bring them in. Take your text from the brooks and not from the booksellers. . . . It is better to have a few forms well studied than to teach a little about many hundred species. Better a dozen forms thoroughly known as the result of the first year's work, than to have two thousand dollars' worth of shells and corals bought from a curiosity store. The dozen animals will be your own. . . . You will find the same elements of instruction all about you wherever you may be teaching. You can take your classes out and give them the same lessons, and lead them up to the same subjects in one place as another. And this method of teaching children is so natural, so suggestive, so true. That is the charm of teaching from Nature. No one can warp her to suit his own views. She brings us back to absolute truth so often as we wander."

ETHICS AND RELIGION.

By CRAWFORD HOWELL TOY,
PROFESSOR OF HEBREW IN HARVARD UNIVERSITY.

NO subjects occupy men's attention more than morality and religion. They are patent, ever-present facts, always intruding themselves on our thoughts, and always demanding consideration. They have formed subjects of human reflection since the race of man began; nations have wrought out practical schemes, philosophers have invented systems; thousands of generations have talked over individual facts and ideas. Yet men are far from being at one on the nature of the two and the relation between them.

One opinion, held widely in our own times, is that religion is the creator of ethics—an opinion not unnaturally suggested by the fusion of ethical and religious ideas and practices which exists among us. The masses of our communities are reared in a religious atmosphere. Their first impressions of duty and right are colored by religious ideas and supported by religious sanctions. The most generally accepted and revered ethical codes are contained in the sacred books, and the most prominent preachers of morals are ministers of religion. Our courts of law dispense justice in the name of the Divine Being. Kings rule by the grace of God, and the Congress of the United States has stamped a declaration of the national trust in God on a silver coin. In many countries religion appears at the birth of a child, to initiate it by a symbolic ceremony into the Church; almost everywhere when life is departing religion comes to care for man's future; and it is religion which announces the close of life by the solemn depo-

sition of the body in the grave. There are many who hold that both the content and the impulse of ethical life are given by religion; that man can neither know nor do right without divine aid; and that human virtue, apart from the supernatural element, is a delusion and a snare, since it allures men to a fatal self-dependence by holding out the false hope that they can be really good without divine aid. This is the annihilation of morality in the ordinary sense of the term.

On the other hand, the opinion is held that religion and morals are wholly distinct, neither in any wise affecting the fundamental conceptions or the practical development of the other. According to this view, the two start from different points, have regard to different objects, look to different aims, and follow different methods. Sometimes this distinctness is represented as belonging only to the ideal conception of religion and ethics, sometimes it is claimed as a characteristic of the historical development of the two. Religion, it is said, deals with God, ethics with man; and this difference, it is held, severs the two by a world-wide interval. Such a position may be maintained both by those who accept and by those who reject a supernatural divine revelation of truth. A believer in revelation might hold the atonement of Christ to be a distinctively religious fact, while he might regard the ethical teaching of Jesus or Paul as the product of human experience.

Still another view considers the two as different indeed in origin and modes of development, but, since both are essential elements of life existing from the beginning, as acted on and interpenetrated each by the other. It may be held, for example, that the posture of mind necessary to produce ethical convictions is, if not created, at least modified by the religious theory, the consciousness of the presence of the Deity deepening the instinct or conviction of duty toward one's fellow-men; or that, in the inverse direction, the sentiment of duty toward the Deity is quickened by the feeling of human obligation; or, again, that the hope of reward or the fear of punishment from the supernatural powers may furnish a strong motive for right-doing; or that the ideals of duty, constantly transcending practice, and embodied in the Deity, may be an ethically elevating influence. According to this view, the present ethical religious thought of the world is the product of a long series of interactions between ethical and religious ideas which have grown up more or less independently.

In order to test the correctness of these various opinions, we must consider briefly the history of the development of men's religious and moral ideas and practice. Our knowledge of this history can be only a general one: we have not the data necessary to describe the beginning of any line in human life; we do not know with certainty how man formed his first notion of the super-

natural, or under what conditions his moral life began. There are hypotheses or surmises which we may think natural or probable; but these must, of course, be distinguished from what is known to be fact. Let us begin by defining the principal terms of our inquiry. Religion is the body of beliefs and practices pertaining to the nature and worship of the Deity, and determining man's effort to propitiate him and secure his aid; ethics is the body of beliefs and practices regulating the conduct of man to man. True, this distinction seems to be sometimes abandoned: the Deity is said to be pleased by ethically right conduct, or a religious ceremonial comes to be regarded as having an ethical character. But even in these cases the distinction really exists. For, the conduct held to be acceptable to God not only relates to intercourse between human beings, but exists as a social custom before it is approved by religion; and the religious ceremonial, primarily designed to secure the divine favor, is ethical only in so far as it involves relations among men. This distinction is not affected by the question respecting a divine revelation of truth, for such a revelation might naturally treat duties to God and duties to man as separate sorts of obligation.

Before, however, entering on the discussion of the subject, it may be proper to ask whether our opinion as to the genesis of ethical practice must be modified by belief in a supernatural, divine revelation of truth. I do not inquire whether such revelations have really been given. It is sufficient for our present purpose to ask whether the objective content of the alleged revelation is of such character as to take it out of the line of natural human development. How stands the case, for example, with the ethical teaching of the Hindu, Persian, and Arabian sacred books? The morality of the Koran is in part high and pure, doubtless an advance on the current usage of Mohammed's time. Yet, leaving out of consideration what was borrowed from Jewish and Christian sources, it contains nothing that may not have been the product of human reflection. The social life of the Arabs of that period was comparatively well organized, and Mohammed undertook for the most part only to modify existing customs—to restrain, for example, the rights of divorce and retaliation; and the duties of honesty, justice, kindness, and mercy which he enjoined were such as would naturally suggest themselves to a large-hearted and keen-sighted man anxious to secure the permanence of a new faith and the well-being of his countrymen. The same thing may be said of the moral codes of Zoroaster, the Veda, and Buddha. Of these the last named is the most remarkable so far as regards purity and depth of ethical perception. It has permanent value quite apart from the Buddhist idea of happiness and perfection as consisting in absolute freedom from thought and feeling; its fun-

damental principles of self-culture and self-denial involve a noble and spiritual conception of life, and are capable of leading to the most admirable results. But, even with the obscurity that rests on the beginnings of Buddhism and the moral-religious development that preceded it, none of us will be inclined to deny that it is the outcome of the experience and thoughts of the time. Such, also, appears to be the case with the ethical codes of the Bible. The ordinary social duties which are enjoined in the Old Testament and New Testament, such as honesty, truthfulness, sobriety, kindness to the poor, are common to many times and peoples. All the moral requirements of the Decalogue are found among the Egyptians at a period earlier than that usually assigned to Moses. Even the nobler qualities of love to man, forgiveness of injuries, denial of self, are not without parallel in other communities. In some cases a process of natural development may be observed in the biblical ethics. The prophets enjoin on the Israelites justice and kindness to their own countrymen, but their view does not extend beyond their own land; one of the later law-books (Lev. xix, 18) contains the precept, "Thou shalt love thy neighbor as thyself," but it defines neighbors as "the children of thy people"; the great Jewish lawyer Hillel, toward the end of the first century before the beginning of our era, announced as the central principle of conduct that a man should not do to others what he would not have them do to him; Jesus put this principle into positive shape (the same thing substantially existed among the Chinese and Greeks). The ethical treatise of the Egyptian Ptah-hotep, said by Maspero, Renouf, and other eminent scholars to be the oldest book in the world (its date is put before 2000 B. C.), contains a moral code remarkable for loftiness and spirituality; it enjoins gentleness, forgetting wrong, contentment, kindness, avoidance of pride, of hardness of heart, and of bad temper. It would appear, from the codes of peoples for whom no divine revelation is claimed by us, that man by his unaided efforts has come to the knowledge of the best principles and practices of morality, has not only made admirable rules of conduct, but has perceived that the essence of goodness lies in the character of the soul. If this be so, it is unnecessary to suppose a supernatural divine revelation to account for the ethical phenomena of society. It might be said, indeed, that all this ethical development proceeds from a primitive divine revelation. But this statement rests on no historical proof, nor would it explain the fact that the ethical progress of a nation goes hand in hand with its growth in civilization. If the ancient Hebrews received their ethical code directly from God, whence comes it that manners were milder in Ezra's time than in the pre-exilian prophetic period, less mild in the days of David, and comparatively rude in the period of the Judges? It would be singular if the

generations which stood nearest the revelation were least affected by it.

Religion consists of creed and ritual. What is the origin and nature of these facts? The religious creed is the embodiment of man's view of the supernatural constitution of the universe. It defines the origin and nature of the powers which stand outside of human life, and the manner in which they brought into being the whole system of things; it describes the character of the relations between them and men, resulting from the attributes of the deities. From these premises the ritual law prescribes the processes by which the favor of the supernatural powers is to be secured.

The main article of the creed, the theology or doctrine of the deity, is the result of reflection. Man demands a ground for the external world, which he naturally at first thinks of as animated by spirits like his own. To these spirits he ascribes passions such as he is conscious of in his own nature. Every object becomes for him a living creature; he refers every phenomenon to an invisible spiritual nature. In process of time he separates the agent from the object or phenomenon, and regards it as an independent power, endowed with such qualities as are suggested by the particular conditions of the case. A deity thus arises, who is gradually invested with a history. Myths which embody natural phenomena or ritual processes, legends which spring from vague recollections of historical occurrences, symbolical stories expressing ethical and other thought gather around his person, and gradually build up for him a distinct individuality. The qualities ascribed to him are modified generation after generation and age after age in accordance with the social development of the community. Starting from his undefined, primitive character, the deity becomes a warrior or a sage, malevolent or beneficent according to the conditions which determine his growth. His ethical nature at any given time will reflect the moral ideas of the community at that time. Man's consciousness of the two opposing elements of good and evil in nature will lead him to apportion beneficial and hurtful attributes and acts among the gods. Those of them who are good will be credited with the best qualities that men can think of, and the bad will tend to become as bad as can be. The latter may then retain their independence and autonomy (as in the Persian religion), or they may be degraded to a subordinate position and retain their power and existence only through the sufferance of the supreme Deity (as among the Hebrews).

This process of constructing the deity supposes a parallel process of self-analysis by man. He finds himself forced by all the conditions of life to inquire into his own nature and needs, and thus gradually builds up an anthropology. This belongs in itself to the domain, not of religion, but of science. But it is the neces-

sary basis of religion. Without the knowledge of man the knowledge of God would be useless for religious purposes; the two go hand in hand. The former springs from and is applied to all the relations of human life. The part of it which comes to be distinctively religious is the consciousness of dependence on God, with all the convictions and feelings which therewith connect themselves. This consciousness has a history similar to that of man's theological creed. It is at first simple and fleshly, relating to man's animal passions and needs; it is purified by time, growing till it attains a well-developed ethical-spiritual shape. From being a creature who needs only food and raiment, man comes to be a highly endowed soul with aspirations after moral perfectness, and at each step the deity must be able to satisfy his needs.

The history of the genesis of things is in itself no more religious than anthropology. How the world, and man, and the gods came into existence are essentially scientific questions; they assume a religious aspect from the fact that they are interwoven with man's really religious conceptions. The first attitude of the human mind on these points is one of indifference; men accept known facts without question. A period of reflection follows; interest is felt in the problem of origins. The construction of the world is assigned, of course, to the supernatural powers; the process of creation is thought of as similar to human methods of work: the world is said to have issued from an egg, or to have been formed from the limbs of a giant, or to have been fashioned in some way familiar to man. The genesis of man is explained in a similar manner. He is born of divine or half-divine parents, or fashioned out of stone or clay. The gods themselves are supposed to have issued from earlier gods, who are held to have come into existence in some far-off time out of primitive material, commonly water. The whole process is one of reflection—it is man's effort to embody in living form the forces which he conceives to have been at work in the creation of the universe. It is his first attempt at scientific analysis and construction.

This theological exposition of the world is a necessity of human thought; man can no more ignore it than he can cease to breathe. It is equally necessary that he should define his own relation to the unseen powers around him. They are believed to determine, in large measure, his weal or woe: they send rain and storm, pestilence and famine, sunshine and food; they smite with disease, or maintain in health; they give victory over enemies, and decide the success or failure of all undertakings. In order to secure their favor and aid, he must know what it is in his conduct that pleases or displeases them, and by what processes their anger may be averted and their good-will obtained. At first, the supposed requirements of human conduct are altogether ceremonial;

but they gradually assume an ethical character. Man ascribes his own conscience to the deity; he can not think of the divine as morally inferior to himself; the divine demands are those which man recognizes in his own conscience.

The forms of the ritual are developed out of social customs. The first idea of the primitive man probably is that the deity is to be propitiated by friendly attentions or by a gift, as a human chieftain or other person would be, and the more precious the gift the better. A man would therefore offer that which he held to be dearest to him—even his own flesh and blood; a human life would be considered the costliest of offerings. All the ceremonies of social life were naturally transferred to the sacrifice of the gods. As eating was so prominent a fact for man, he prepared feasts for his deities; tables were spread, and food and drink were offered. It was assumed that the gods shared men's love of praise; hymns were sung celebrating the divine power and glory. Sometimes a malevolent nature was ascribed to the deity: it was supposed that he was jealous of man's prosperity, and that his displeasure was to be removed by the sacrifice of something which the man esteemed valuable—a costly ring, for example, would be thrown into the sea; but woe to the offerer if it should be found in a fish and returned to him! Out of this primitive material of sacrifices, feasts, praise, and thanksgiving, have arisen all the complicated liturgies and rituals of the world. The outward form of them has followed the customs of society. That which in social intercourse came to be considered seemly and reverent was adopted as the proper attitude toward the gods. The dress of the ministers of religion, words of supplication or praise which they employed, the posture of the worshipers, have always been determined by the forms of human society. The basis of religious service is man's desire to secure the friendship of the deity, its form is determined by the social proprieties. These last must therefore be looked on as an accessory of religion, important as means, but not belonging to its essence.*

Parallel with the religious development is the growth of moral ideas and the elaboration of systems of practical ethics. These also are founded in the nature of things, inasmuch as they have never failed to appear in human society. It is not our purpose here to attempt an explanation of the origin of those instincts on which society is founded, and which furnish the basis of moral character. So far as we know, the complementary instincts of self-maintenance and sympathy are inseparable from the nature of man. They are found, indeed, in the lower forms of being, and were doubtless inherited by man from his ancestors of a lower type; but, in any case, they are now to be considered essential

* It is not here intended to deny that ritual may be a symbolic representation of ideas.

parts of the human constitution, and out of them spring all the details of ethical life. Nor are we called on to discuss the origin of the sentiment of obligation, since we are warranted in holding that it also belongs to the essence of human nature. No man, so far as our information goes, has ever been found to be destitute of it, and, as far as concerns our world, it may be regarded as founded in the nature of things. It is the basis of all moral development. The only question that need be asked is whether it is at all dependent on religion for its essential character—that is to say, at the moment when this sentiment was shaping itself in the mind of man, was its genesis at all conditioned on the recognition of the supernatural? In the decision of such a question we can be guided, of course, only by data of our own consciousness. But the reference to the supernatural does not seem to help the matter much, since we meet here at the outset this same sentiment of obligation. What is the origin of the convictions of duty which man feels toward the unseen powers around him? Does it spring from the recognition of their superiority of position? But this is nothing more than the recognition of a relation which involves the power of harming or helping in the superior being, and, so far as the same power is supposed to reside in men, the same sentiment toward them will arise. Or does the feeling of duty toward the gods come from the recognition of rights belonging to them? Then it does not appear why there should not be a similar recognition of rights belonging to men, since in the earliest conceptions there is no difference between man and the deity, except in the point of power. It does not seem, therefore, that religion has been effective in producing the feeling of obligation, except so far as it has added to the objects toward which this feeling was directed. There would be just as much ground for holding that the sentiment of religious obligation sprang from the feeling of duty which arose between man and man. In point of fact, no doubt, both were products of the same primitive elements of man's constitution. The recognition of an object implies the recognition both of its nature and of those powers in it by which it affects us for good or for bad, and from the interplay of these ideas comes finally the conviction that the object has certain rights; we first perceive and estimate the personality, and then, through experience and reflection, come to the conclusion that it is obligatory on us to allow it such freedom as is consistent with the freedom of other personalities. The degree of liberty we allow will be, in general, in proportion to the power of the personality: men can be controlled by equal powers; the gods, wielding irresistible power, will enjoy perfect liberty. The two sorts of feeling of duty, toward man and toward the deity, grow by mutual action and reaction; each, as it becomes more refined

and powerful, communicates something of its qualities to the other. In man's progress in culture of soul there is no part of his nature that does not affect and is not affected by all other parts.

Let us pass on to the details of man's ethical codes. It is generally agreed that the great mass of these spring from the experiences of human intercourse. The ordinary moral rules of life have arisen from men's observation that without them society is not possible. Such is the origin of the feeling against theft, murder, and falsehood. The family life is dependent on the subordination of children to parents, and the tribal or national life on the obedience of subjects to rulers. The early particular perceptions of the law of kindness arise from a compromise between the instincts of self-development and sympathy. A man helps his fellow-man, but not more than is consistent with the maintenance of his own interest. There are special instincts, like that of maternal love, which carry with them absolute self-abnegation. In process of time moral principles acquire a certain universality, and are embodied in ideal forms of men or gods, and these ideals and principles assume an independent shape and enter as independent forces into moral life. Even the broadest and most unselfish ethical conceptions and usages of our best developed societies are thus to be traced back to the habits of thought which arise from social intercourse.

The results of the ethical thought of society are adopted by religion. Observation, as is remarked above, teaches that so soon as the constitution of the community becomes distinctly moral, its religion assumes the same tone — the content of the divine character becomes moral, and the deity is conceived to be pleased by conduct which is in accord with his character. It need not be thought derogatory to religion that it should depend on the experiences of human society for its moral teachings. The essence of religion is not the content of the divine personality, but man's desire to put himself in sympathy with the divine. The ethical character with which man enters into relation is, of course, of extreme importance; but the human mind can not truly appropriate thoughts which it has not learned by experience, and no divine ideal would be effective which had not previously been wrought out by the mind itself.

Such an ideal may exert a powerful influence on life, but only on condition that it correspond with ethical conceptions held by the community in which it exists. If there is a conflict between these two standards, there is in most cases no doubt as to which of them will determine conduct: men will follow their own convictions, preserving a respectful attitude toward the divine, but ignoring its guidance in this point. Illustrations of this fact are

probably to be found in all advanced societies. Plato wished to banish the poets from his Republic because he feared the influence of the immoral stories they told of the gods. But his very protest shows that he and the members of his circle had risen above the moral plane of these stories; and, in fact, it is clear from the writings of the period, especially those of Æschylus, Sophocles, Plato, Xenophon, Demosthenes, not to speak of the Stoics, that the moral conduct of men was determined at that time, not by the example of the gods, but by such social considerations as influence us at the present day; it would no doubt have been thought ridiculous if, for example, a man had adduced precedents in the lives of Zeus or Hermes or Aphrodite in defense of conduct condemned by the laws and usages of Athens. A similar ineffectiveness of divine precedent may be observed in Christian societies of our own time, who listen Sunday after Sunday, devoutly but with complete ethical indifference, to procedures represented in the Old Testament as based on divine command, but foreign to our modes of thought. I once heard from a learned clergyman an argument of an hour to show that Abraham's purpose to offer his son could not reasonably be regarded as an example for us, since Abraham was certain that he had the divine command, while we are not warranted in believing that we enjoy personal direction from God of that sort. The occasion of the discourse was the shocking history of a citizen of Massachusetts, who, aided and abetted by his wife, sacrificed his child in obedience to a supposed command from God. But people generally disposed of the matter more simply by saying that the man was crazy, and so he was adjudged to be in a court of law; the general feeling was that no sane man could thus go counter to the ethical principles of our time. The command to exterminate the Canaanites, though it may be vaguely regarded by many as having been right at that time, would not now be pleaded by the general of an army or by a minister of war as authority for wholesale slaughter of enemies. Theoretically these things are widely looked on as divine; but the popular instinct, with easy illogicalness, decides that for some reason or other they do not belong to our times. The explanation, of course, is simple: these procedures were the product of half-barbarous communities, or at any rate of a period when men saw nothing wrong in them; they were repudiated by the moral sense of the later Jews. Slavery, recognized as lawful in the Hebrew and Christian Scriptures, is now condemned by the civilized world; and the New Testament teaching on this subject is explained, by those who hold the biblical ethics to be absolutely correct, as a wise reticence: the apostle Paul, it is said, refrained from interfering with the social institutions of his time, and trusted to the regenerating power of the

principles of the gospel. It is true that there is a spirit in the New Testament which is antagonistic to the enslaving of human beings. But it is also true that Paul saw no incompatibility between slavery and Christianity, and it is only recently that the Christian world has come to a definite conclusion on this point. It is not long since devout men in England, Russia, Brazil, and the United States defended slavery on biblical and moral grounds; and the present condemnation of it is to be regarded as a product of the modern social movement toward the recognition of all human rights.

The relation of divine standards to human experience is illustrated in our own times by the discussions on various points of social morals. The Catholic Church, following what it supposed to be the New Testament teaching, affirmed the perpetuity of the marriage relation and the impossibility of divorce. There is a difference of opinion among biblical expositors as to the meaning of the passage in which the Founder of Christianity has expressed his opinion on this point (Matt. v, 32); some hold that there is one scriptural ground of divorce, others that there is none. Modern legislators and social philosophers, however, proceed without reference to the biblical rule. The old church law has been abandoned in most countries, and in the discussions which take place in private circles the arguments on the subject are based not on scriptural grounds but on considerations supposed to connect themselves with the well-being of society. There are many questions for the decision of which there is no specific religious authority; they have arisen from distinctly modern conditions of life, of which the older religious books, of course, take no note. Such questions may often, perhaps always, be brought under general ethical principles announced in the Bible. But the particular application of these principles, the practical decision of present questions of duty, is determined by existing social conditions. Whether capital punishment should be abolished, how far the use of alcoholic drinks should be allowed or prohibited by the state, whether parks and museums should be thrown open to the public on Sundays, whether the theatre should be favored or opposed—these questions are all discussed on modern social grounds.

Has religion contributed any idea to ethics? It might seem at first view that this question must be answered in the affirmative. The Church has at various times imposed laws on the world. The ethical life of Europe has been deeply affected by the church law of divorce. The celibacy of the clergy, a purely ecclesiastical enactment, has had far-reaching moral consequences. In all times and countries the ministers of religion have had more or less to do with the establishment of customs and laws relating

to morals. And yet it must be considered doubtful whether, by the authority of ministers of religion or by the experience of the individual conscience, religion has ever originated an ethical principle. We have seen above that the hypothesis of a supernatural divine revelation is not necessary in order to explain the existence of our ethical principles and practices. We have also seen further that these principles and practices have their origin in general not in man's feeling toward the divine, but in his intercourse with his fellow-creatures. There seems to be no rule of ethical usage among us that does not finally go back to our view of its bearing on the well-being of society. This last is the final standard by which we test all our arguments on moral questions. If we wish to decide on the desirableness of flogging on board ships, we ask whether it maintains discipline better than any other punishment, and how it affects the character of the sailor, it being assumed that the proper development of the individual is an essential element of social progress. In the same way we treat all disciplinary problems—capital punishment, solitary confinement, corporal chastisement by parents and teachers: we inquire into the effect on the individual, but the individual as a member of society. We recognize individual rights, but we do not hesitate to sacrifice them to the welfare of the whole. No sympathy with a culprit affects us if we believe that the good of the community requires his punishment. An argument which demonstrates the best social good is considered final. In the prohibition controversies the only point really considered by the disputants is, Does prohibition prohibit? Is war lawful? The answer is given by appeal to the necessities of national life.

But how is it with cases of priestly legislation? Are they not contributions of religion to ethics? In all such cases I believe it will be found that the ethical principle involved is one which has already been established by society and is only applied by religion. As an example let us take the institution of taboo, whose usages are so widely spread in civilized as well as uncivilized countries. Taboo sets certain things apart as sacred or as the special property of gods or men, not to be owned or used by others. Obviously an ethical principle enters here, since the use of tabooed objects by the community becomes wrong; and, as taboo is an essentially religious idea, it may be said that religion has here established a moral rule. But let us see whether this is really the case. The customs of taboo are of two sorts, those which relate to the gods and to persons and places consecrated to their worship, and those which relate to ordinary social intercourse.

The reverence required for images of deities, for sacred buildings and their furniture and ministers, is of course a purely re-

ligious sentiment. Of this nature was the sacredness which attached among the Hebrews to the temple and especially to the holy of holies, which none but a minister of religion might enter; and to the sin-offering, which only the priests were permitted to eat. Persons devoted in any way to the Deity were debarred from certain things which were supposed to render them impure; here there was no question of an infringement of a moral law, but only the feeling that contact with or use of certain objects impaired the religious efficiency of the devoted person, probably because such acts and objects were held for some reason to be displeasing to the Deity, or to vitiate the body, or to interfere with the functions of a ministrant. In some cases we can see the grounds for these provisions, in other cases they go back to customs of unknown origin. The Jewish Nazarite was forbidden to eat or drink of the products of the vine or to cut his hair; the first of these injunctions was probably a survival from the old nomadic life, in which the vine was not cultivated (so also in the case of the Rechabites), the second regarded the hair as a seat of life, and therefore as a symbol of the divine presence and authority. The Roman *flamen dialis* enjoyed many privileges as a high representative of a god, but on the other hand was enveloped in an extraordinary mass of restrictions: he could not be out of the city a single night, or sleep out of his own bed three consecutive nights; and no one else might sleep in his bed. He was forbidden to swear an oath; to wear any but a plain ring; to walk along a path covered by vines; to touch flour, leaven, or a dead body; to touch or to name a dog, a she-goat, ivy, beans, or raw flesh. When his hair and nails were cut, the clippings and parings were buried beneath a tree whose fruit could be offered to the superior deities. His wife was surrounded by similar restrictions. Evidently some of these were intended to keep the priest faithful to his duties, to secure his presence at the temple. The objects he was forbidden to touch were doubtless held, from some forgotten customs, to be distasteful to the deity (taboo). That there was no real ethical element in the prohibition appears from the fact that other men might do the forbidden things with impunity. We may compare the modern notions in some communities which require clergymen to wear certain sorts of dress, or insist on their refraining from certain things which are regarded as lawful for other men. A minister of religion offending in these points we regard not as immoral, but rather as improper; a Roman priest so offending would have been looked on as guilty of impiety toward the deity and toward the state.

In undeveloped communities the honors paid to the gods are naturally transferred to chiefs and royal persons supposed to be descended from the gods. We may thus explain the prohibition

of the use of their names by other men, and the custom would be so far religious; but it would probably be encouraged by the chiefs on governmental grounds, and would in so far be ethical. Even the religious usage probably goes back to the sentiment of respect felt for the chiefs as rulers.

A number of taboo customs seem to be probably or possibly social. The prohibition of the use of the flesh of a particular animal or of a whole class of animals as food is of uncertain origin. It is supposed by some to result from the idea of *totems*, each tribe refraining from the flesh of its own totem, but other considerations may have entered in part at least into the usage, and the origin of totemism itself is unknown. The rule among some tribes that women shall not eat human flesh is possibly social; it was perhaps intended to guard the character of women. When it is forbidden to touch a dead body or a burial-ground, or a man who has slain an enemy, the idea of pollution thus incurred may be physical, though it may also come from the belief that the dead person is a spirit or inhabited by a spirit. It is possible also that this last may be the ground of the rule that persons dangerously ill should not be touched; here, however, a physical reason may have been effective. The appropriation or protection of property by taboo depends on ordinary principles of social organization. When a chief declares that a certain object is his head or his hand, and thereby secures it for himself, this is merely using the religious sanction to give authority to what we may suppose to be a natural disposition in chiefs, namely, to appropriate as much of the property of their tribesmen as possible. A private man who declares his field taboo, and thus prohibits other men from entering it, is only asserting the right of private property and calling in the aid of religion.

It may fairly be said that those taboo usages which are really ethical arise from ideas which have been established by social intercourse. In the case of the sick person, for example, that certain persons are forbidden to touch him is a religious usage, and if the prohibition were universal, it would be fatal to the sick man; but the helpfulness of those persons who actually tend him comes from the kindly relations engendered by ordinary social intercourse, which overbear the religious prohibition. It does not appear that taboo has ever pronounced any class of actions to be good or bad; it has only brought particular acts under existing moral categories. Neither it nor any other religious institution has ever in the first instance taught men that it was wrong to steal or right to be kind.

So far we have regarded only the content of ethical usage. We now have to ask whether, if religion has received its code from ethics, it has not communicated something in return. It is

a noteworthy fact that many great ethical teachers have been at the same time religious reformers; such were Zoroaster, Buddha, Jesus, and Mohammed. In other cases, as in the codes of the Egyptian Ptah-hotep and of Socrates, though there is no religious revolution, a religious atmosphere is present. Where religion seems to be lacking, as in the case of Confucius, still it may be said that the ethical system has arisen in a community permeated with religious ideas. From these facts it might be supposed that religion has been the most powerful influence in the world in the elaboration of moral codes. But it must be borne in mind that at a period when religion was bound up with common life much more closely than now, a practical thinker (and such the great religious reformers were) could not separate the two. In Semitic nations not only morals but government also was bound up with religion. Ethics and religion were so intertwined in human development that, though their origins and laws of growth may have been different, they had come together into a substantial unity.

In thus associating itself with ethics, religion supports it by supernatural sanctions. It is a question of serious import, which doubtless now occupies many minds, whether the moral status of society could be maintained without this external aid. It is a question to which no decided answer can be given, because the experiment has never been tried. The probability is that, if the religious element of thought were now abruptly eliminated from our society, the moral life would suffer enormously if it did not perish outright. Such a sudden withdrawal is, however, impossible, and need not enter into our calculations. The elimination of religion, if it can be conceived of as possible, could be effected only by a very gradual process, during which men would be little by little trained under other influences. The vanishing of religion, indeed, out of human life is hardly conceivable; but we may suppose that the conception of its sanctions may change—the physical-supernatural form of them may give way to the moral. This change has actually begun: a not inconsiderable section of the Christian world now believes that the rewards and punishments which attach to well-doing and ill-doing are determined by natural law, whether in the physical or in the moral life. Nor can we see that the effect of this change on the ethical status of society is bad. If the bodily rewards and punishments have vanished, new and strong ethical motives have been introduced; there is a deeper sense of personal responsibility, and there are higher ideals.

A still more fundamental inquiry is how far the practical ethical life of the world is affected by the belief in future rewards and punishments. But to discuss this point properly would

require a collection of data which has not yet been made. It has been said that men are deterred from wrong-doing much more by the fear of immediate punishment than by the prospect of a retribution which seems indefinitely remote. Such, certainly, appears to a superficial view to be the state of the case; a keen observer of human life long ago remarked that because sentence against an evil work is not executed speedily, therefore the heart of the sons of men is fully set in them to do evil. But who can read the deeper-lying motives of men? Who knows what profounder ethical direction is given to life by the constant contemplation of recompense beyond the grave? The history of human virtue and vice has unfolded itself, almost without exception, in the atmosphere of this belief. One noted exception there is—the early Semites, the Assyrians, and the Jews prior to B. C. 300, appear to have lived practically without recognition of the future, and it does not seem that their morality was inferior to that of other nations; we ourselves indeed must acknowledge that, so far as our practical life is concerned, we have something to learn from the codes of the prophets and the law. But it must be said, on the other hand, that the Jews of that time had a powerful ethical stimulus which is wanting in our time—namely, a vivid belief in the immediateness of divine interventions in human life. An experiment of a morality supported only by human sanctions has never been tried in modern times on a large scale. Nor can it be doubted that the belief in future retribution exerts a powerful influence on men's lives. Strictly speaking, however, this belief does not belong to the domain of religion. Its precise origin is doubtful, but it has arisen from man's reflection on his own life, and not on his relation to the Deity. Its relations with both religion and ethics are close, but it can not properly be said to represent an influence of the former on the latter.

It appears, then, that the real substance of man's ethical code has not been affected by religion. The belief in supernatural rewards and punishments, though it influences men's conduct, is not a moral force; it has no power to change the heart. The true salutary influence of religion on human life is found in the creation of divine ideals to be loved and imitated. Such an ideal is the embodiment of man's own highest ethical conceptions. Vitalized into a person, ethical perfectness acquires an independent power, attracting and stimulating us, lifting us up above the ordinary low level of our lives, inspiring us by presenting a goal to be reached, and encouraging us with the hope of divine aid. The standard of human achievement is expressed in the exhortation of Jesus to men to be perfect as God is perfect, and the proper emotional attitude in the Old Testament declaration that men are to love God with all the heart. Such a love toward God

as a perfect being implies the love of right in man's soul; but this love may exist in incomplete or feeble form, and may be heightened and developed by constant contemplation of ideal goodness; it is still further aided by the sentiment of gratitude in response to benefits believed to have been received from the hand of God.

The effect of such ideals is both to ennoble individual character and to elevate the moral standard of the community. A conception of perfectness formed by the best minds always goes beyond the general practice, and calls into being principles of action which gradually make their way from the few to the many. A gradual reorganization of society is thus effected; social intercourse is based on these enlarged ethical views, habits spring up in accordance with them, they create new grooves for men's sympathies and interests, so that it becomes, as a rule, easier to act with than against them, easier in general to do right than to do wrong. It is impossible, however, to define the influence of the ideal precisely, to separate it from the general effects of social life. Take, for example, the principles of forgiveness and revenge as they exist among us. The recognized religious ideals in all parts of this country inculcate the duty of forgiveness of injuries, and yet the practice varies greatly in different regions. The difference of custom appears to depend chiefly on difference of social organization. In those communities which are semi-feudal in character, where there is comparatively little social organization, and individuality of action has been cultivated, the habit of revenge for personal injuries is more common; while in those communities in which commercial interests are stronger, and social combinations firmer and more numerous, personal vengeance is rarer, and the appeal to society and law more frequent. Whether there is a corresponding difference in the temper of the soul may be a question; yet it is probable that the constant habit of refraining from private retaliation induces a more peaceful and self-restraining attitude of heart. The effect of the religious ideal is, however, seen in individuals in all Christian communities, who practice forgiveness out of loyalty and love to the divine lawgiver. And it is impossible to say how far this ideal has everywhere affected the feeling of men through the example of those who have manifested obedience to the religious law of forgiveness.

There are, of course, ethical as well as religious ideals, and these have had their due effect. The moral progress of men has been effected by the combination of the two great factors, the organization of society and ethical-religious ideals. Every step taken toward binding men closer together in social life, and every announcement and practical exhibition of a supereminent ethical

principle is an element of advance toward social perfection. The progress may be largely external, and change of heart does not always accompany conformity to rule; nevertheless, long-continued habit is almost sure to produce change in men's conception of life.

DARWIN ON THE FUEGIANS AND PATAGONIANS.*

HAVING now finished with Patagonia and the Falkland Islands, I will describe our first arrival in Tierra del Fuego. A little after noon we doubled Cape St. Diego and entered the famous Strait of Le Maire. We kept close to the Fuegian shore, but the outline of the rugged, inhospitable Staten-land was visible amid the clouds. In the afternoon we anchored in the Bay of Good Success. While entering we were saluted in a manner becoming the inhabitants of this savage land. A group of Fuegians, partly concealed by the entangled forest, were perched on a wild point overhanging the sea; and, as we passed by, they sprang up and waving their tattered cloaks sent forth a loud and sonorous shout. The savages followed the ship, and just before dark we saw their fire, and again heard their wild cry. The harbor consists of a fine piece of water half surrounded by low, rounded mountains of clay-slate, which are covered to the water's edge by one dense, gloomy forest. A single glance at the landscape was sufficient to show me how widely different it was from anything I had ever beheld. At night it blew a gale of wind, and heavy squalls from the mountains swept past us. It would have been a bad time out at sea, and we, as well as others, may call this Good Success Bay.

In the morning the captain sent a party to communicate with the Fuegians. When we came within hail, one of the four natives who were present advanced to receive us, and began to shout most vehemently, wishing to direct us where to land. When we were on shore the party looked rather alarmed, but continued talking and making gestures with great rapidity. It was without exception the most curious and interesting spectacle I ever beheld: I could not have believed how wide was the difference between savage and civilized man: it is greater than between a wild and domesticated animal, inasmuch as in man there is a greater power of improvement. The chief spokesman was old, and appeared to be the head of the family; the three others were powerful young men, about six feet high. The women and children had been sent

* From advance sheets of a new edition, illustrated by R. T. Pritchett, of Darwin's "Journal of Researches" made during the voyage round the world of H. M. S. Beagle, in preparation by D. Appleton & Co.

away. These Fuegians are a very different race from the stunted, miserable wretches farther westward; and they seem closely allied to the famous Patagonians of the Strait of Magellan. Their only garment consists of a mantle made of guanaco-skin, with the wool outside; this they wear just thrown over their shoulders, leaving their persons as often exposed as covered. Their skin is of a dirty coppery-red color.

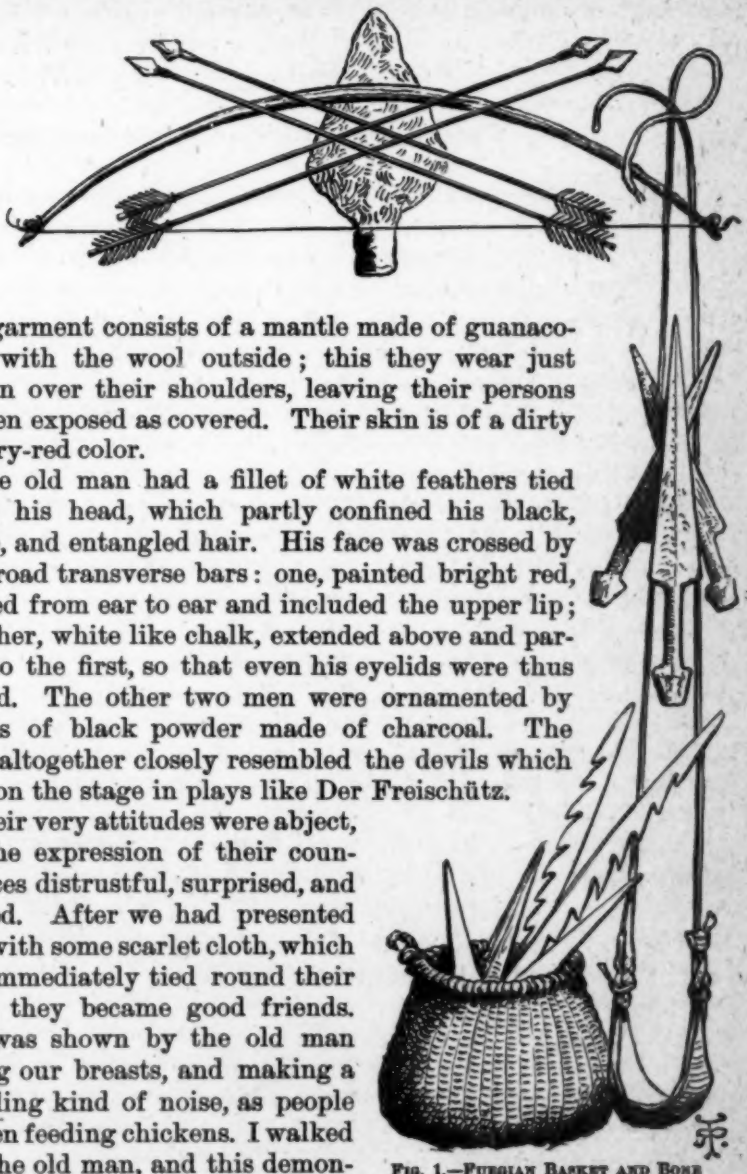


FIG. 1.—FUEGIAN BASKET AND BONE WEAPONS.

The old man had a fillet of white feathers tied round his head, which partly confined his black, coarse, and entangled hair. His face was crossed by two broad transverse bars: one, painted bright red, reached from ear to ear and included the upper lip; the other, white like chalk, extended above and parallel to the first, so that even his eyelids were thus colored. The other two men were ornamented by streaks of black powder made of charcoal. The party altogether closely resembled the devils which come on the stage in plays like Der Freischütz.

Their very attitudes were abject, and the expression of their countenances distrustful, surprised, and startled. After we had presented them with some scarlet cloth, which they immediately tied round their necks, they became good friends. This was shown by the old man patting our breasts, and making a chuckling kind of noise, as people do when feeding chickens. I walked with the old man, and this demonstration of friendship was repeated several times; it was concluded by three hard slaps, which were given me on the breast and back at the same time. He then bared his bosom for me to return the compliment, which being done, he seemed highly pleased. The language of these people, according

to our notions, scarcely deserves to be called articulate. Captain Cook has compared it to a man clearing his throat, but certainly no European ever cleared his throat with so many hoarse, guttural, and clicking sounds.

They are excellent mimics: as often as we coughed or yawned, or made any odd motion, they immediately imitated us. Some of our party began to squint and look awry; but one of the young Fuegians (whose whole face was painted black, excepting a white band across his eyes) succeeded in making far more hideous grimaces. They could repeat with perfect correctness each word in any sentence we addressed them, and they remembered such words for some time. Yet we Europeans all know how difficult it is to distinguish apart the sounds in a foreign language. Which of us, for instance, could follow an American Indian through a sentence of more than three words? All savages appear to possess, to an uncommon degree, this power of mimicry. I was told, almost in the same words, of the same ludicrous habit among the Caffres; the Australians, likewise, have long been notorious for being able to imitate and describe the gait of any man, so that he may be recognized. How can this faculty be explained? Is it a consequence of the more practiced habits of perception and keener senses, common to all men in a savage state, as compared with those long civilized?

When a song was struck up by our party, I thought the Fuegians would have fallen down with astonishment. With equal surprise they viewed our dancing; but one of the young men, when asked, had no objection to a little waltzing. Little accustomed to Europeans as they appeared to be, yet they knew and dreaded our firearms; nothing would tempt them to take a gun in their hands. They begged for knives, calling them by the Spanish word *cuchilla*. They explained also what they wanted, by acting as if they had a piece of blubber in their mouths, and then pretending to cut instead of tear it.

It was as easy to please as it was difficult to satisfy these savages. Young and old, men and children, never ceased repeating the word *yammerschooner*, which means "give me." After pointing to almost every object, one after the other, even to the buttons on our coats, and saying their favorite word in as many intonations as possible, they would then use it in a neuter sense, and vacantly repeat *yammerschooner*. After yammerschoonering for any article very eagerly, they would by a simple artifice point to their young women or little children, as much as to say, "If you will not give it me, surely you will to such as these."

There is one vegetable production deserving notice from its importance as an article of food to the Fuegians. It is a globular, bright-yellow fungus, which grows in vast numbers on the beech-

trees. When young it is elastic and turgid, with a smooth surface; but when mature it shrinks, becomes tougher, and has its entire surface deeply pitted or honeycombed, as represented in the accompanying woodcut. This fungus belongs to a new and curious genus. I found a second species on another species of beech in Chili; and Dr. Hooker informs me that just lately a third species has been discovered on a third species of beech in Van Diemen's Land. How singular is this relationship between parasitical fungi and the trees on which they grow, in distant parts of the world! In Tierra del Fuego the fungus in its tough and mature state is collected in large quantities by the women and children, and is eaten uncooked. It has a mucilaginous, slightly sweet taste, with a faint smell like that of a mushroom. With the exception of a few berries, chiefly of a dwarf arbutus, the natives eat no vegetable food besides this fungus. In New Zealand, before the introduction of the potato, the roots of the fern were largely consumed; at the present time, I believe, Tierra del Fuego is the only country in the world where a cryptogamic plant affords a staple article of food.

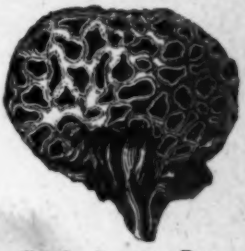


FIG. 2.—CYTTARIA DARWINII.

FIG. 3.—PATAGONIANS FROM CAPE GREGORY.

In the end of May, 1834, we entered for the second time the eastern mouth of the Strait of Magellan. The country on both sides of this part of the strait consists of nearly level plains, like those of Patagonia. Cape Negro, a little within the second Narrows, may be considered as the point where the land begins to

assume the marked features of Tierra del Fuego. On the east coast, south of the strait, broken, park-like scenery in a like manner connects these two countries, which are opposed to each other in almost every feature. It is truly surprising to find in a space of twenty miles such a change in the landscape. If we take a rather greater distance, as between Port Famine and Gregory Bay, that is about sixty miles, the difference is still more wonderful. At the former place we have rounded mountains concealed by impervious forests, which are drenched with the rain brought by an endless succession of gales; while at Cape Gregory there is a clear and bright blue sky over the dry and sterile plains. The atmospheric currents, although rapid, turbulent, and unconfined by any apparent limits, yet seem to follow, like a river in its bed, a regularly determined course.

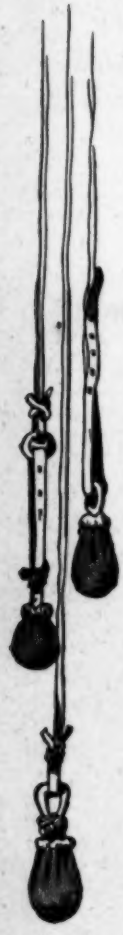


FIG. 4.—PATAGONIAN BOLAS.

During our previous visit (in January), we had an interview at Cape Gregory with the famous so-called gigantic Patagonians, who gave us a cordial reception. Their height appears greater than it really is, from their large guanaco mantles, their long, flowing hair, and general figure; on an average their height is about six feet, with some men taller and only a few shorter; and the women are also tall; altogether, they are certainly the tallest race which we anywhere saw. In features they strikingly resemble the more northern Indians whom I saw with Rosas, but they have a wilder and more formidable appearance: their faces were much painted with red and black, and one man was ringed and dotted with white like a Fuegian. Captain Fitz Roy offered to take any three of them on board, and all seemed determined to be of the three. It was long before we could clear the boat; at last we got on board with our three giants, who dined with the captain, and behaved quite like gentlemen, helping themselves with knives, forks, and spoons: nothing was so much relished as sugar. This tribe has had so much communication with sealers and whalers that most of the men can speak a little English and Spanish; and they are half civilized, and proportionally demoralized.

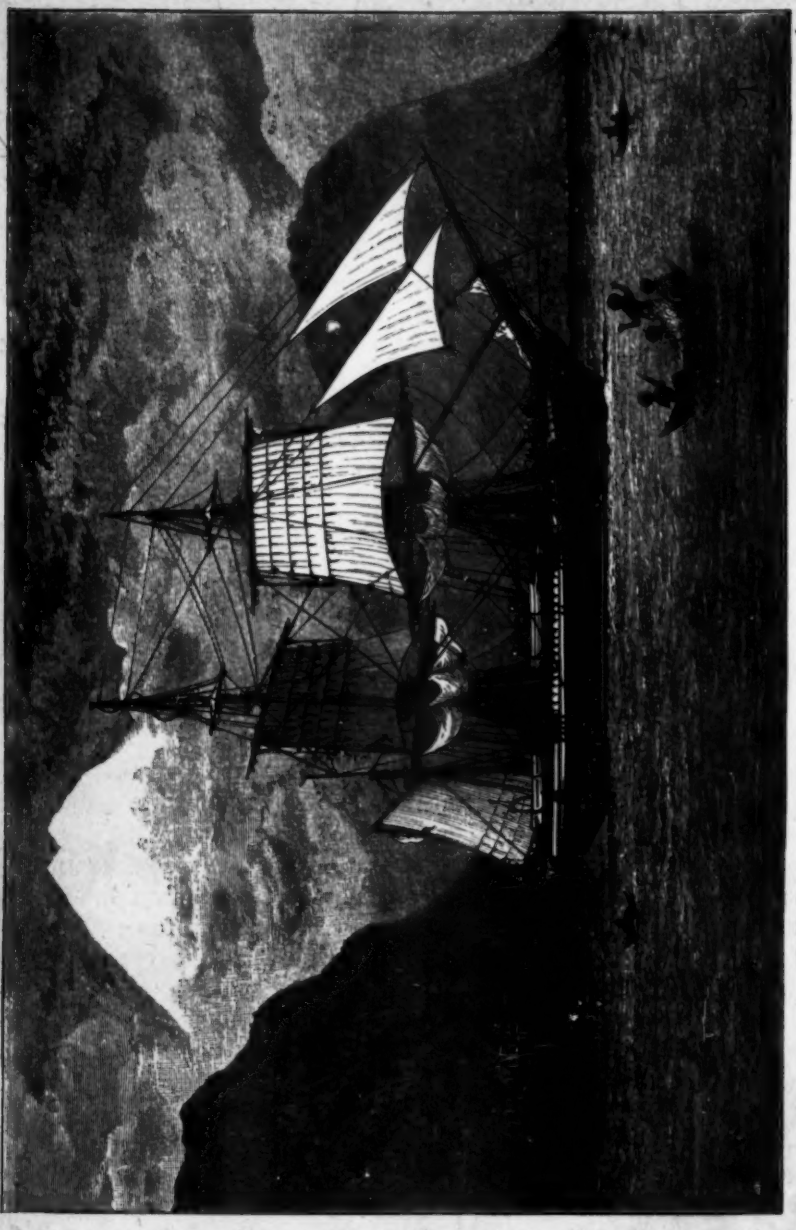
The next morning a large party went on shore, to barter for skins and ostrich-feathers; firearms being refused, tobacco was in greatest request, far more so than axes or tools. The whole population of the *toldos*, men, women, and children, were arranged on a bank. It was an amusing scene, and it was impossible

not to like the so-called giants, they were so thoroughly good-humored and unsuspecting; they asked us to come again. They seem to like to have Europeans to live with them; and old Maria, an important woman in the tribe, once begged Mr. Low to leave any one of his sailors with them. They spend the greater part of the year here; but in summer they hunt along the foot of the Cordillera; sometimes they travel as far as the Rio Negro, seven hundred and fifty miles to the north. They are well stocked with horses, each man having, according to Mr. Low, six or seven, and all the

FIG. 5.—PATAGONIAN SPURS AND PIPE.

women, and even children, their one own horse. In the time of Sarmiento (1580) these Indians had bows and arrows, now long since disused; they then also possessed some horses. This is a very curious fact, showing the extraordinarily rapid multiplication of horses in South America. The horse was first landed at Buenos Ayres in 1537, and the colony being then for a time deserted, the horse ran wild; in 1580, only forty-three years afterward, we hear of them at the Strait of Magellan! Mr. Low informs me that a neighboring tribe of foot-Indians is now changing into horse-Indians; the tribe at Gregory Bay giving them their worn-out horses, and sending in winter a few of their best skilled men to hunt for them.

June 1st.—We anchored in the fine bay of Port Famine. It was now the beginning of winter, and I never saw a more cheerless prospect; the dusky woods, piebald with snow, could be only seen indistinctly through a drizzling, hazy atmosphere. We were, however, lucky in getting two fine days. On one of these, Mount Sarmiento, a distant mountain six thousand eight hundred feet high, presented a very notable spectacle. I was frequently surprised, in the scenery of Tierra del Fuego, at the little apparent elevation of mountains really lofty. I suspect it is owing to a cause which would not at first be imagined, namely, that the



H. M. S. Beagle in Straits of Magellan—Mount Sarmiento in the Distance.

whole mass, from the summit to the water's edge, is generally in full view. I remember having seen a mountain, first from the Beagle Channel, where the whole sweep from the summit to the base was full in view, and then from Ponsonby Sound across several successive ridges; and it was curious to observe in the latter case, as each fresh ridge afforded fresh means of judging of the distance, how the mountain rose in height.

IS EDUCATION OPPOSED TO MOTHERHOOD?

By ALICE B. TWEEDY.

IF, as Max Müller asserts, the first duty of honest philosophers is definition, there can be no doubt that in following it many clouds of discussion may be swept away. Definitions are continually assumed, and we clothe our creeds in wordy obscurity that totally hides their nature. No subject suffers more from this error than the woman question. If debated words were rigidly defined, and results placed barely before us, many sentimental arguments would fail in foundation.

In "Plain Words on the Woman Question,"* Mr. Grant Allen discusses a topic which, he thinks, is "too much overlooked by modern lady writers." It is the continuation of the human race. Intrenched behind population and marriage statistics, he opens fire upon feminine reformers from a quarter where they have made little defense. His text is—if a race will continue, it must reproduce itself. His argument may be briefly given as follows:

I. Marriages are decreasing in England and America.

II. Women of the cultivated classes are becoming unfitted for motherhood.

III. The movement which demands the independence and higher education of women is responsible for this—it creates a "spiritless epicene automaton" and the "self-supporting spinster."

IV. The emancipation of women, especially from Mrs. Grundy, is desirable; but it must not conflict with the existence of mothers who are necessary to the race.

Mr. Allen states the needful conditions of a stationary population in this manner: A father and mother are exactly represented in another generation by two children, a boy and a girl. But, in order that two may attain maturity, four† must be born; so that either every woman must have four children, or those who do marry must have more than four to make up the requisite number. From this he deduces: "The best ordered community will be one where as large a proportion of women as possible marry. Where many marriages and small families are the rule, the children will on the average be born healthier, be better fed, and be launched more fairly on the world in the end."

After clearly stating and carefully explaining these indisputable facts, Mr. Allen startles us by acknowledging that "it may be brutal and unmanly to admit or insist upon them," as he has been

* "Popular Science Monthly," December, 1889.

† This number is based upon the present proportion of children who become healthy adults, statistics which ought to be materially altered for the better.

"often told it is by maiden ladies"! There is but one intelligent attitude concerning them—are they true or false? Granting, then, that these conditions are truthfully represented, what can be said to the argument which Mr. Allen founds upon them?

I. Marriages are decreasing in many civilized countries. There are local causes for this tendency among men, but the principal and prevailing one with women is that they are passing from the rule of force to a state of freedom, and use their newly found liberty to reject what seems to hamper and handicap them. They are emerging from the condition in which marriage is consequent upon physical or social constraint, and they have not generally arrived at the point where it is for them the result of deliberate choice or response to natural instinct. In China, India, Persia, and Arabia, where marriages are still controlled by force, the number would be diminished at once, without the influence of higher education or industrial training, were the women allowed simple freedom of choice.* This decrease would not indicate "the dulling of feminine instinct," but the vitality of it—since marriages are made there in defiance of natural selection, and represent the worst condition of servitude. In more civilized states the popularity of marriage does not depend wholly upon the way in which women regard it, but upon the way in which it is treated by men. The laws of some countries render it easier for a man to live illegitimately with a woman than to marry her;† true marriage is discouraged by social usage and dishonored by false philosophy. Few thoughtful minds will deny that the customs which render it difficult for a young man to marry, which send him hither and thither to gain a fortune, succeed in a profession, or dissipate his strength, when he should be choosing his sweetheart, are harmful, and divert men "from the true problem of their sex to fix it on side issues of comparative unimportance."

Boys, as well as girls, should be taught that the full meaning of human life is missed unless they deserve and find a fitting mate! Authors who represent wifehood and maternity‡ as onerous and unattractive, however necessary, or who surround illicit and in-

* It is related that in 1878 eight young girls living near Canton, having been betrothed, arrayed themselves one evening in fine attire, bound themselves together, and plunged into the river to avoid marriage.

† In Germany, where marriage is forbidden the younger soldiers, the birth statistics are disadvantageous to the state.

‡ Some English conservatives discourse on these topics in a strain wholly abhorrent to healthy women. They write of "the *inexorable law* from which, however *distasteful*, a woman can not escape"; "the *stern* law that makes women wives and mothers." One would imagine from them that marriage and motherhood made a yawning grave of hope and aspiration. Normal women, who have passed through these experiences, use no woful tones in description.

complete love with superficial glamour, are open to the charge of depreciating marriage. Guests are not tempted to a banquet by fear of starvation, nor are men attracted toward matrimony for the interests of the race. Instead of showing that marriage offers the greatest possibility of happiness, it is often described by men as an unintellectual, slavish, and pitiable condition. Few epithalamia are sung by the generation which asks, "Is marriage a failure?" and rare is the poet who writes:

> "Clear as amber, fine as musk,
> Is life to those who, pilgrim-wise,
> Move hand in hand from dawn to dusk."

II. Mr. Allen seems to regard as evidence that women "are becoming unfitted for motherhood" the fact that they do not glory in their femininity, and charges also that women reformers speak and write "as though it were desirable that the mass of women should remain unmarried forever." Worse even than this, he asserts: "At the present moment a great majority of the ablest women are wholly dissatisfied with their own position as women, and with the position imposed by the facts of the case upon women generally; this as the direct result of their false education." Here are two ideas badly entangled for want of definition—the natural and the artificial position of women. Mr. Allen gives us on the following page his opinion of "the position" (artificial) of women in language strong enough for the most blatant reformer. "The position of women was not a position which could bear the test of nineteenth-century scrutiny; . . . their relation to the family, to their husbands, their children, their friends, their property, was simply insupportable." (Does he demand of these ablest women that they should be satisfied with a position he calls "insupportable"?) But, let him not be distressed because woman does not openly "glory" in her natural position of womanhood. There is no failure of healthy instinct here, but a natural feminine divergence from the masculine feeling. The differentiation of the sexes is a subject upon which we have no adequate data. We might as well try to surmise the habits of the wild cat from the domesticated pussy, as to speculate upon the essential qualities of free womanhood. But, so far as woman's physical constitution indicates anything, it points toward greater reserve on her part than is exhibited by man. This corresponds with the almost universal inclination of women to be more modest than men.* Therefore, though a woman may prefer her own sex and be proud of her privileges as woman, she will not voluntarily go about "glorifying" her womanhood. If Mr. Allen should meet a young woman who announced herself a candidate for mother-

* A few savage tribes form exceptions to this rule.

hood, it is doubtful whether he would approve of her, although she embodied his theory.*

Here, also, Mr. Allen misinterprets the women reformers of England. He states that they "openly refuse and despise marriage." Some may; some write very bitterly of men. But this refusal is for themselves, or for the class to which they belong—reformers. In this they do not differ from a large number of religious or political enthusiasts of both sexes, in every age, who claim that their "cause" is superior to individual rights or duties. Who is the woman in England who maintains such doctrine for the majority of her sex? One of the ablest advocates for women, Emily Pfeiffer,† writes to her countrymen:

> "You do not well to rest your hope
> On natures of a narrower scope,
> And leave the souls which, like your own,
> Aspire, to find their way alone—
> To go down childless to their graves,
> The while you get your sons of slaves."

Though men have greatly outgrown tyranny of thought and action, there is still alive much masculine arrogance. With many it is entirely unconscious; it probably is so with Mr. Allen when he calls a literary or scientific education "mannish." I do not know of any purely mannish training except that received by the monks of La Trappe, and that which fits men to be soldiers, sailors, blacksmiths, or workmen whose physical force is a necessity to their calling. A college or university education, although in past years given exclusively to men, was never supposed to fit them for any essentially masculine occupation, not even to become the fathers of the future race. It was preliminary to a professional or literary career, and intended to develop the powers of mind. And mind—emphasize as we will the physical differences of the body that goes with it—has no discoverable gender. The lavish way in which the epithet of "masculine" or "feminine" has been applied to particular minds is utterly destructive of precision of thought. Vigorous minds are called masculine and those of the namby-pamby, sentimental sort are dubbed feminine. This classification may be historically justifiable by the slight appearance women have made in the literary and scientific world,

* In college days I knew a young lady medical student who illustrated this doctrine. She openly proclaimed that she studied medicine for the purpose of fitting herself to become a wife and mother. She enlarged her waist, wore most ungraceful garments, broached her pet idea on social occasions, and was the *bête noire* of her companions. Perhaps she was Mr. Allen's ideal of an emancipated woman. Her fellow-students thought she had missed the inheritance of womanly instinct, or that some secondary male characteristic had cropped out in her. At last accounts she had not put her precepts into practice.

† "A Rhyme for the Time," "Contemporary Review."

but there have been clear-headed women enough in all antiquity, and there are too many well-developed minds among them to-day, not to make them resent further tricking out with masculine trappings. The wise old Greeks saw fit to personify mind in a woman; the moderns seem to be afraid of such a result.

If education must be specialized, and women should be fitted to become wise mothers, then, in all fairness, men should be trained to become intelligent fathers. Their lack in this respect is as palpable to any just mind as the failure of women in motherhood. That there should be fathers, and good fathers, is no less important, from a utilitarian standpoint, than that there should be good mothers. Indeed, it may be questioned whether there are not annually more children lost to the world through the wickedness and ignorance of male parents* than would be gained by the conversion of all "self-supporting spinsters" into model matrons. It is not necessary to enter into detail here, but appalling statistics are easily obtainable. Until no foundling hospital, no abandoned family exists, it is ungenerous to reproach woman with evading or "shirking" her natural duties. Postponement of marriage by men results in another not inconsiderable evil, false marriage† of many young women. Nature often revenges herself here by a lack of mothers. The wiser plan would be to follow the teaching of Nature and not dissociate the sexes, particularly during impressionable years. In study, work, or society, do not bar them from each other; then they will not form the erroneous notions that taint maturity. Let them be "human, instead of half-human."

III. The most evident good of education to woman, aside from the discipline of mind and development of power, is in its teaching observation of nature and the intelligent use rather than the repression of any instinct or force. Those who assert that these influences "unsex" woman, render her "unwomanly," should explain what is meant. She may lose some of the characteristics that have distinguished her in the past, but while analytic or radical minds call these characteristics local and temporary, conservatives cling to them as part of essential womanhood. It may be observed that, although Mr. Allen holds fast to the term of "radical," he agrees with our dear old great-grandmothers in this apprehension that education‡ and independence unfit women to become mothers. To these timid souls may be recommended a

* Meaning the sex as a whole. The large class with which we are best acquainted includes fathers whose fidelity to duty and patient toil equal, if they do not surpass, those of the hardest-working mothers.

† Marriage under coercion, or from social or ambitious motives, ignores natural selection, and is often unproductive. A striking example of this is given in France, where false marriage prevails.

‡ The same education as that given to man.

greater trust in Nature, that she will be able to maintain the differences necessary to a continuance of the race.* Clothes and customs vary with time and place; sex is stable and not injured by anything but physical condition. The traditional idea that womanhood can be modified in some occult † way by occupation, training, or environment, is wholly unscientific and *baneful;* for it undoubtedly serves to nurse in many a woman that "slavishness of soul" which Mr. Allen, as a true well-wisher of woman, deplores. Physical condition, then, is the constant coefficient in the problem. Anything injurious to the health of either man or woman incapacitates each just so much for the fullest requirement of life.

Mr. Allen claims that the result of the higher education in England and America has been to convert woman into "a dulled and spiritless epicene automaton." Now, this peculiar product, which I take to mean the opposite of a healthy woman, must be wholly within the reach of statistics, else she, or it, is a fabulous affair. In England it is possible she may exist, but the best available statistics of Girton, Newnham, and Cheltenham prove that she is not typical. The following testimony in regard to women students is given: ‡

"I have known intimately Girton and Newnham Colleges and what is now the women's department of Owens College, Manchester. . . . Were an impression to get abroad that a thorough school and college education is injurious to tolerably healthy women, it would be as *mistaken* as it would be unfortunate" (Miss Bulley).

"My unqualified testimony is, that the intellectual quickening resulting from advanced education is of great benefit to their physical condition" (Miss Mackillip, Londonderry Collegiate School).

"I have been head of this college for more than twenty-eight years. . . . *We have kept the minutest possible statistics* *—these show that girls, working under proper conditions, are exceptionally healthy" (Miss Beale, Cheltenham College).

Mr. Fitch, inspector of training schools, testifies: "There are in England twenty-six training colleges for schoolmistresses, containing in all eighteen hundred resident students. It is my duty, on behalf of the Government, to make an annual visit to these institutions, and I have seen every one of them during the last twelve months. . . . It is the uniform opinion of the medical

* The average notion of manliness or womanliness is very fluctuating. A young man showing great interest in laces and hosiery would be considered to-day an effeminate fellow; yet in the time of Charles I such attention to fripperies was deemed manly enough.

† "Principles of Biology," Herbert Spencer; "Sex in Mind and in Education," Henry Maudsley, M. D.

‡ "Woman and Work," Emily Pfeiffer, pp. 115, 117, 128.

* Six hundred and twenty-seven pupils passed senior and higher university examinations.

officers that the students improve in health and vigor during their two years of residence."

In America, the dulled automaton is not discoverable; indeed, the records are so much in favor of a healthier class than the average of women that physicians who have hastily committed themselves to an opposite opinion say, upon examination, that they "utterly distrust the statistics"! * The necessary amount of this distrust, and the direction in which it is exercised, may be estimated by citing the authorities for the health of women students: Secretary of the Society of Associated Alumnæ of American Colleges,† seven hundred and five alumnæ who report personally; Committee of Education, 1883–'84, Washington; Addresses of President Angell, of Michigan University; ex-President White, of Cornell; and President Horace Davis, of the University of California.

But, it may be asked, "Are doubting physicians not justified at all—are there no women students who break down ‡ or die?" There are such cases of overstrain or feeble constitution which find their parallel among men, but the percentage among women is so small that it leaves the health average still above the generality of women.

But, urges Mr. Allen, there is "the self-supporting spinster"; "almost every woman should marry"; and she is "a deplorable accident." Now, it is possible that while I may deem her admirable, another may consider her "deplorable"—it is a matter of taste merely. But, that she is not an "accident," rather an eternal verity, stands confessed in Mr. Allen's "almost." Unless, indeed, the entire community should be paired off—which is not desirable for economic reasons—spinsters and bachelors will continue to exist. It does not materially affect the issues of the race whether they are dependent or independent,* and we may fearlessly praise in them the qualities which please us most. If the condition of "self-supporting spinsterhood" is more attractive than the condition of wifehood, there is menace for the future.

* Dr. Weir Mitchell, "Wear and Tear," p. 151.

† Report published at Boston, May, 1885.

‡ Rumors of this kind are sometimes too readily circulated. "Serious case, that of Miss O.," said a prominent physician in a Western city; "she has returned from Vassar thoroughly overworked." "Who, Carrie O.?" exclaimed a young lady hearer. "O doctor, that isn't possible! She was the giddiest girl in our class, went to parties three or four nights in the week, never had a lesson, and so Miss M. dropped her. When she found she couldn't graduate, she went to Vassar as a special student, because, she said, 'it was so far away no one would know whether she stood high or not, and she didn't intend to study her eyes out.'" The doctor's countenance fell. One victim of "higher education" was crossed off the score.

* It is desirable that young women should support themselves for these reasons: (1) that they may be free to marry; (2) in case they fail of marriage; and (3) because sickness or accident to the husband may render a wife's support valuable.

It would be alarming, if we could believe with Mr. Allen in anything so unflattering to masculine endeavor; but, unfortunately, there are no statistics to prove whether this is due to dulled feminine instinct, or to the failure of man to make love at the right time. In the interim, from collateral evidence, the latter cause appears more trustworthy.

IV. If freedom from Mrs. Grundy is desirable, it is patent that education and independence are gradually liberating woman. The counter-charge is often made that the educated woman is too regardless of that favored deity.

From a biological point of view, Mr. Allen endows four years of college training with enormous potentiality. In this he evidently follows the eminent leader, Mr. Herbert Spencer, who asserts that the infertility of "upper-class girls" in England is due to "overtaxing of their brains"!* Whether the majority of English "upper-class girls" are educated to that extreme point, and whether the question is not begged in the use of the word "overtaxation," may be left to the reader. It is strange that powerful heredity and palpable causes of race deterioration should be ignored by physiologists† in order to throw the *onus* of this accusation upon mental culture. Insurance tables are made out more scientifically than this forecast of a girl's future. If in education, or in the industrial independence of women, there existed any tendency toward infertility, it would be barely discoverable in our generation, little more so in the next, and possibly in the third generation something might be ascertained from careful statistics following Mr. Galton's method. Nature does not retrograde so rapidly. There is nothing to warrant the assumption that four years of altered food, training, or environment, not interfering with good physical condition, could obliterate an instinct or function. Investigation corroborates this. Even in England, we learn that infertility and higher education are not synonymous terms. A teacher of wide experience states:‡ "I know several families of children whose mothers were among the pioneers of the movement now so savagely attacked. . . . Among my friends, not a few sturdy, handsome children, whose mothers underwent severe study in their earlier days. One of these was a lady who, with one other, was the first woman to take the classical tripos, and whose degree was not beaten, I think, for ten years." In America, in "a report given of the family conditions of one hundred and thirty alumnæ who have

* "Principles of Biology."

† Similar premature judgment was given by the late Dr. E. H. Clarke, of Boston, in 1871, "Sex and Education." See also "Woman's Work in Creation," Dr. B. W. Richardson, "Longman's Magazine," October, 1886.

‡ "Woman and Work," p. 116.

had children, the exceptional record of good health among these children, and their low death-rate, are strong evidences that the powers of motherhood have not suffered from college work."* In addition, the writer's mite of testimony may be offered. In the schools which she has attended,† the majority of earnest students were in uniformly good health; a minority were delicate before beginning study. The most frequent examples of ill health were found among those who made a pretense of study and eagerly pursued social excitements. Subsequent effect upon the health may be judged when it is found that twelve years after graduation one young woman, ranking at the head of her class, is the mother of six vigorous children; two others, earnest students, have each a family of five, and a number of others have four children. No correspondence has been held with married classmates living at a distance. These mentioned are personally known to be mothers in the fullest sense, and constitute striking contradictions to the claim that education has an injurious effect upon woman. "But," it may be objected, "these are exceptionally healthy women." Undoubtedly, but if the training has any influence at all, it should make them fall slightly below the standard of the preceding generation, whereas, in several instances, they improved upon the record of their mothers, not only in general health, but in the condition and size of their families.

If, now, we review the discussion to this point, it may be summed up as follows:

I. Decrease of marriage results from a transition state in the condition of women, also from unjust laws and false social customs which discourage matrimony.

II. Able women generally are not dissatisfied with womanhood, and do not advocate celibacy. It is not evident that women of any class are *becoming unfitted* for motherhood, but women of the "cultivated classes" *are not* the best possible mothers. Independent and highly educated women are only a fraction among these, and can not be substituted for the whole.

III. The higher education of woman teaches her reverence for Nature; the development and control, *not* the suppression of natural instinct, therefore tends to make her the best wife and mother. The "spiritless epicene automaton" is mythical. The spinster is an eternal verity. The woman movement has not created her, but changed her condition from dependence to self-support.

IV. The education and independence of women is a step in emancipation even from Mrs. Grundy, but it can not be made responsible for the present infertility among women, for these reasons:

* Report of "Health Committee, Association Collegiate Alumnæ," Annie G. Howes, 1885.

† Four schools for girls, one college for women, two universities for men and women.

First. It is too recent in effect, having barely reached the second generation. Second. There are more potent causes—heredity, race deterioration, and false marriage. Third. It actually produces healthy wives and mothers in the fullest sense.

There is no denial of the fact that too large a percentage of educated women,* as well as of the cultivated classes generally, remain unmarried. However, it has been shown in regard to the former, that "dulled instinct" is not a tenable cause. Some have attributed it more wisely to increased "nicety of choice." This may prove beneficial in the end, when man shall have become a more importunate suitor.

Women can no longer be coerced into marriage, nor will they marry from a sense of duty to humanity. But for these reasons there need be no fear that the race will perish. There is as much prospect that roses will refuse to bloom in June as that women will ever become invincible to love. This force, and this alone, can make of them light-hearted mothers in place of the weary wrecks whose perverted motherhood has been anything but a boon to humanity. As long as it is taught that motherhood oppresses woman physically and restricts her intellectually, so long the average woman may dread or rebel against it. When she studies it in all its conditioning, she finds it does not impose such a fate upon her. She learns to discriminate between the ordering of Nature and the blunders of mankind, and recognizes that normal physical development can not be antagonistic to mental growth.

If, as is known among the lower forms of life, there should be such evil fate in store for women as *parthenogenesis* or *polyembryony*, or any entire change of function or structure, it would be quite useless to rebel. Even such highly imaginary metamorphosis would not imply extinction of species. The causes of this calamity have not been fathomed by Darwin nor Weissman; and, if such disintegrating forces were at work among us, who would be wise enough to recognize them?

Study of nature leads us to believe that, if the individual be free and supplied with the means of life, there is great probability of the survival of his kind. However, we have seen that the human race decreases under artificial conditioning, and, if we are concerned lest man should become extinct, let us strive to live simply, naturally; neither separate nor antagonize the sexes; then there may be more need of Mr. Malthus than of any pessimistic prophecy on the danger of developing a woman's mind.

* Highly educated women are yet a minority among women of the so-called "cultivated classes," and are better ranked with working women, since they agree with them more nearly in habits of life.

ON THE NATURAL INEQUALITY OF MEN.

By Prof. T. H. HUXLEY, F.R.S.

THE political speculations set forth in Rousseau's "Discours sur l'origine de l'inégalité parmi les hommes," and in the more noted essay, "Du Contrat Social," which were published, the former in 1754 and the latter eight years later, are, for the most part, if not wholly, founded upon conceptions with the origination of which he had nothing to do. The political, like the religious, revolutionary movement of the eighteenth century in France came from England. Hobbes, primarily, and Locke, secondarily (Rousseau was acquainted with the writings of both), supplied every notion of fundamental importance which is to be found in the works which I have mentioned. But the skill of a master of the literary art and the fervor of a prophet combined to embellish and intensify the new presentation of old speculations; which had the further good fortune to address itself to a public as ripe and ready as Balak himself to accept the revelations of any seer whose prophecies were to its mind.

Missionaries, whether of philosophy or of religion, rarely make rapid way, unless their preachings fall in with the prepossessions of the multitude of shallow thinkers, or can be made to serve as a stalking-horse for the promotion of the practical aims of the still larger multitude, who do not profess to think much, but are quite certain they want a great deal. Rousseau's writings are so admirably adapted to touch both these classes that the effect they produced, especially in France, is easily intelligible. For, in the middle of the eighteenth century, French society (not perhaps so different as may be imagined from other societies before and since) presented two large groups of people who troubled themselves about politics—in any sense other than that of personal or party intrigue. There was an upper stratum of luxurious idlers, jealously excluded from political action and consequently ignorant of practical affairs, with no solid knowledge or firm principles of any sort; but, on the other hand, open-minded to every novelty which could be apprehended without too much trouble, and exquisitely appreciative of close deductive reasoning and clear exposition. Such a public naturally welcomed Rousseau's brilliant developments of plausible first principles by the help of that *a priori* method which saves so much troublesome investigation.*

* In his famous work on "Ancient Law" the late Sir Henry Maine has remarked, with great justice, that Rousseau's philosophy "still possesses singular fascination for the looser thinkers of every country"; that "it helped most powerfully to bring about the grosser disappointments of which the first French Revolution was fertile," and that "it gave birth, or intense stimulus, to the vices of mental habit all but universal at the time, disdain of

It just suited the "philosophes," male and female, interchanging their airy epigrams in *salons*, which had about as much likeness to the Academy or to the Stoa, as the "philosophes" had to the philosophers of antiquity.

I do not forget the existence of men of the type of Montesquieu or D'Argenson in the France of the eighteenth century, when I take this as a fair representation of the enlightened public of that day. The unenlightened public, on the other hand, the people who were morally and physically debased by sheer hunger; or those, not so far dulled or infuriated by absolute want, who yet were maddened by the wrongs of every description inflicted upon them by a political system which, so far as its proper object, the welfare of the people, was concerned, was effete and powerless; the subjects of a government smitten with paralysis for everything but the working of iniquity and the generation of scandals; these naturally hailed with rapture the appearance of the teacher who clothed passion in the garb of philosophy; and preached the sweeping away of injustice by the perpetration of further injustice, as if it were nothing but the conversion of sound theory into practice.

It is true that any one who has looked below the surface* will hardly be disposed to join in the cry which is so often raised against the "philosophes" that their "infidel and leveling" principles brought about the French Revolution. People, like the Marquis d'Argenson, with political eyes in their heads, saw that the revolution was inevitable before Rousseau wrote a line. In truth, the Bull "Unigenitus," the interested restiveness of the Parliaments, and the extravagancies and profligacy of the court had a great deal more influence in generating the catastrophe than all the "philosophes" that ever put pen to paper. But, undoubtedly, Rousseau's extremely attractive and widely read writings did a great deal to give a color of rationality to those principles of '89† which, even after the lapse of a century, are considered

positive law, impatience of experience, and the preference of *a priori* to all other reasoning" (pp. 89–92). I shall often have to quote "Ancient Law." The first edition of this admirable book was published in 1861, but now, after eighteen years of growing influence on thoughtful men, it seems to be forgotten, or willfully ignored, by the ruck of political speculators. It is enough to make one despair of the future that Demos and the Bourbons seem to be much alike in their want of capacity for either learning or forgetting.

* Those who desire to do so with ease and pleasure should read M. Rocquain's "L'esprit révolutionnaire en France avant la Révolution." It is really a luminous book, which ought to be translated for the benefit of our rising public men, who, having had the advantage of a public-school education, are so often unable to read French with comfort. For deeper students there is, of course, the great work of M. Taine, "Les origines de la France contemporaine."

† Sir H. Maine observes that the "strictly judicial axiom" of the lawyers of the Antonine era ("omnes homines naturâ æquales sunt"—all men are by nature equal), after passing through the hands of Rousseau, and being adopted by the founders of the Constitution

by a good many people to be the Magna Charta of the human race. "Liberty, Equality, and Fraternity," is still the war-cry of those, and they are many, who think, with Rousseau, that human sufferings must needs be the consequence of the artificial arrangements of society, and can all be alleviated or removed by political changes.

The intellectual impulse which may thus be fairly enough connected with the name of the Genevese dreamer has by no means spent itself in the century and a half which has elapsed since it was given. On the contrary, after a period of comparative obscurity (at least outside France), Rousseauism has gradually come to the front again, and at present promises to exert once more a very grave influence on practical life. The two essays to which I have referred are, to all appearance, very little known to the present generation of those who have followed in Rousseau's track. None the less is it true that his teachings, filtered through innumerable channels and passing under other names, are still regarded as the foundations of political science by the existing representatives of the classes who were so much attracted by them when they were put forth. My friend Mr. John Morley, who probably knows more about Rousseau and his school than anybody else,* must have been entertained (so far as amusement is possible to the subject of the process of "heckling") when Rousseau's *plats*, the indigestibility of which he exposed so many years ago, were set before him as a wholesome British dish; the situation had a certain piquancy, which no one would appreciate more keenly.

I happened to be very much occupied upon subjects of a totally different character, and had no mind to leave them, when the narrative of this occurrence and some letters to which it gave rise, appeared in the "Times." But I have very long entertained the conviction that the revived Rousseauism of our day is working sad mischief, leading astray those who have not the time, even when they possess the ability, to go to the root of the superficially plausible doctrines which are disseminated among them. And I thought it was my duty to see whether some thirty years' training in the art of making difficult questions intelligible to audiences without much learning, but with that abundance of keen practical sense which characterizes English workmen of the better class,

of the United States, returned to France endowed with vastly greater energy and dignity, and that "of all 'the principles of 1789' it is the one which has been least strenuously assailed, which has most thoroughly leavened modern opinion, and which promises to modify most deeply the constitution of societies, and the politics of states" ("Ancient Law," p. 96).

* If I had not reason to think that Mr. Morley's "Rousseau," and Sir Henry Maine's "Ancient Law," especially the admirable Chapters III and IV, must be unknown to many political writers and speakers, and *a fortiori* to the general public, there would be no excuse for the present essay, which simply restates the case which they have so exhaustively treated.

would enable me to do something toward the counteraction of the fallacious guidance which is offered to them. Perhaps I may be permitted to add that the subject was by no means new to me. Very curious cases of communal organization and difficult questions involving the whole subject of the rights of property come before those whose duty it is to acquaint themselves with the condition of either sea or fresh-water fisheries, or with the administration of fishery laws. For a number of years it was my fate to discharge such duties to the best of my ability; and, in doing so, I was brought face to face with the problem of land-ownership and the difficulties which arise out of the conflicting claims of commoners and owners in severalty. And I had good reason to know that mistaken theories on these subjects are very liable to be translated into illegal actions. I can not say whether the letters which I wrote in any degree attained the object (of vastly greater importance, to my mind, than any personal question) which I had in view. But I was quite aware, whatever their other results, they would probably involve me in disagreeable consequences; and, among the rest, in the necessity of proving a variety of statements, which I could only adumbrate within the compass of the space that the "Times" could afford me, liberal as the editor showed himself to be in that respect. What I purpose to do in the course of the present article, then, is to make good these shortcomings; to show what Rousseau's doctrines were, and to inquire into their scientific value—with, I hope, that impartiality which it beseems us to exhibit in inquiries into ancient history. Having done this, I propose to leave the application of the conclusions at which I arrive to the intelligence of my readers, as I shall thus escape collision with several of my respected contemporaries.*

I have indicated two sources from which our knowledge of Rousseau's system may be derived, and it is not worth while to go any further. But it is needful to observe that the dicta of the author of the "Contrat Social," published in 1762, are not unfrequently very hard—indeed, I might say impossible—to reconcile with those of the author of the "Discours," which appeared eight years earlier; and that, if any one should maintain that the older

* From Mr. Herbert Spencer's letter in the "Times" of November 27, 1889, I gather that he altogether repudiates the doctrines which I am about to criticise. I rejoice to hear it: in the first place, because they thus lose the shelter of his high authority; secondly, because, after this repudiation, anything I may say in the course of the following pages against Rousseauism can not be disagreeable to him; and, thirdly, because I desire to express my great regret that, in however good company, I should have lacked the intelligence to perceive that Mr. Spencer had previously repudiated the views attributed to him by the land socialists. May I take this opportunity of informing the many correspondents who usually favor me with comments (mostly adverse, I am sorry to say) on what I venture to write, that I have no other answer to give them but Pilate's, "What I have written I have written"? I have no energy to waste on replies to irresponsible criticism.

essay was not meant to be taken seriously, or that it has been, in some respects, more or less set aside by the later, he might find strong grounds for his opinion. It is enough for me that the same *a priori* method and the same fallacious assumptions pervade both.

The thesis of the earlier work is that man, in the "state of nature," was a very excellent creature indeed, strong, healthy, good, and contented; and all the evils which have befallen him, such as feebleness, sickness, wickedness, and misery, result from his having forsaken the "state of nature" for the "state of civilization." And the first step in this downward progress was the setting up of rights of several property. It might seem to a plain man that the argument here turns on a matter of fact: if it is not historically true that men were once in this "state of nature"—what becomes of it all? However, Rousseau tells us, in the preface to the "Discours," not only that the "state of nature" is something which no longer exists, but that "perhaps it never existed, and probably never will exist." Yet it is something "of which it is nevertheless necessary to have accurate notions in order to judge our present conditions rightly." After making this singular statement, Rousseau goes on to observe: "Il faudrait même plus de philosophie qu'on ne pense à celui qui entreprendrait de déterminer exactement les précautions à prendre pour faire sur ce sujet de solides observations." (More philosophy indeed is needed than one thinks for him who undertakes to determine exactly the precautions to be taken to make solid observations on this subject.) And, certainly, the amount of philosophy required to base an argument on that which does not exist, has not existed, and perhaps never will exist, may well seem unattainable —at any rate, at first sight. Yet, apart from analogies which might be drawn from the mathematical sciences—where, for example, a straight line is a thing which has not existed, does not exist, and probably never will exist, and yet forms a good ground for reasoning; and the value of which I need not stop to discuss —I take it that Rousseau has a very comprehensible idea at the bottom of this troublesome statement. What I conceive him to mean is that it is possible to form an ideal conception of what ought to be the condition of mankind;* and that, having done so, we are bound to judge the existing state of things by that

* Compare "Ancient Law": "The Law of Nature confused the Past and the Present. Logically, it implied a state of Nature which had once been regulated by Natural Law; yet the jurisconsults do not speak clearly or confidently of the existence of such a state" (p. 73). "There are some writers on the subject who attempt to evade the fundamental difficulty by contending that the code of Nature exists in the future and is the goal to which all civil laws are moving" (p. 74). The jurisconsults conceived of Natural Law "as a system which ought gradually to absorb Civil Laws" (p. 76). "Its functions were, in short, remedial, not revolutionary or anarchical. And this unfortunately is the exact point

ideal. That assumption puts us on the "high *priori* road" at once.

I do not suppose that any one is inclined to doubt the usefulness of a political ideal as a goal toward which social conduct should strive, whether it can ever be completely realized or not; any more than any one will doubt that it is useful to have a moral ideal toward which personal conduct should tend, even though one may never reach it. Certainly, I am the last person to question this, or to doubt that politics is as susceptible of treatment by scientific method as any other field of natural knowledge.* But it will be admitted that, great as are the advantages of having a political ideal, fashioned by an absolute rule of political conduct, it is perhaps better to do without one, rather than to adopt the first phantasm, bred of fallacious reasonings and born of the unscientific imagination, which presents itself. The benighted traveler, lost on a moor, who refuses to follow a man with a lantern, is surely not to be commended. But suppose his hesitation arises from a well-grounded doubt as to whether the seeming luminary is anything but a will o' the wisp? And, unless I fail egregiously in attaining my purpose, those who read this paper to the end will, I think, have no doubt that the political lantern of Rousseauism is a mere corpse-candle and will plunge those who follow it in the deepest of anarchic bogs.

There is another point which must be carefully borne in mind in any discussion of Rousseau's doctrines; and that is the meaning which he attaches to the word "inequality." A hundred and fifty years ago, as now, political and biological philosophers found they were natural allies.† Rousseau is not intelligible without Buffon, with whose earlier works he was evidently acquainted, and whose influence in the following passage is obvious:

> It is easy to see that we must seek the primary cause of the differences by which men are distinguished in these successive changes of the human constitution; since it is universally admitted that they are, naturally, as equal among

at which the modern view of a Law of Nature has often ceased to resemble the ancient" (p. 77).

*In the course of the correspondence in the "Times" to which I have referred, I was earnestly exhorted to believe that the world of politics does not lie outside of the province of science. My impression is that I was trying to teach the public that great truth, which I had learned from Mill and Comte, thirty-five years ago; when, if I mistake not, my well-meaning monitor was more occupied with peg-tops than with politics. See a lecture on the "Educational Value of the Natural History Sciences" delivered in 1854 ("Lay Sermons," p. 97).

† The publication of Buffon's "Histoire Naturelle" began in 1749. Thus Rousseau was indebted to the naturalists; on the other hand, in the case of the elder Darwin, who started what is now usually known as Lamarck's hypothesis, the naturalist was set speculating by the ideas of the philosopher Hartley, transmitted through Priestley. See "Zoonomia," I, sect. xxxix, p. 483 (ed. 1796). I hope some day to deal at length with this curious fact in scientific history.

themselves as were the animals of each species before various physical causes had produced, in some of them, the varieties which we observe. In fact, it is not conceivable that these first changes, by whatever means they were brought about, altered, at once and in the same way, all the individuals of a species; but some having become improved or deteriorated, and having acquired different qualities, good or bad, which were not inherent in their nature, the others remained longer in their original state; and such was the first source of inequality among men, which is more easy to prove thus, in a general way, than to assign exactly to its true causes. ("Discours," preface.)

In accordance with this conception of the origin of inequality among men, Rousseau distinguishes, at the outset of the "Discours," two kinds of inequality:

the one which I term *natural*, or *physical*, because it is established by nature, and which consists in the differences of age, health, bodily strength, and intellectual or spiritual qualities; the other, which may be called *moral*, or *political*, because it depends on a sort of convention, and is established, or at least authorized, by the consent of mankind. This last inequality consists in the different privileges which some enjoy, to the prejudice of others, as being richer, more honored, more powerful than they, or by making themselves obeyed by others.

Of course the question readily suggests itself: Before drawing this sharp line of demarkation between natural and political inequality, might it not be as well to inquire whether they are not intimately connected, in such a manner that the latter is essentially a consequence of the former? This question is indeed put by Rousseau himself. And, as the only answer he has to give is a piece of silly and insincere rhetoric about its being a question fit only for slaves to discuss in presence of their masters, we may fairly conclude that he knew well enough he dare not grapple with it. The only safe course for him was to go by on the other side and as far as the breadth of the road would permit; and, in the rest of his writings, to play fast and loose with the two senses of inequality, as convenience might dictate.

With these preliminary remarks kept well in view, we may proceed to the discussion of those fundamental theses of the "Discourse" and of the "Social Contract" which Rousseau calls the "principes du droit politique." Rousseau defines his object thus:

Je veux chercher si dans l'ordre civil il peut y avoir quelque règle d'administration légitime et sûre, en prenant les hommes tels qu'ils sont et les lois tels qu'elles peuvent être. Je tâcherai d'allier toujours dans cette recherche ce que le droit permet avec ce que l'intérêt prescrit, afin que la justice et l'utilité ne se trouvent point divisées.* (I seek to know if there may be in the civil order any legitimate and sure rule of civil administration, taking men as they are and laws as they might be. I shall try to combine in this research what the law permits with what interest prescribes, so that justice and utility shall not find themselves divided.)

* "Contrat Social," livre 1er. Compare Hobbes's dedication of "Human Nature" written in 1640: "They who have written of justice and policy in general do all invade each other

In other words, our philosopher propounds "sure," that is "absolute," principles which are, at once ethically and politically, sufficient rules of conduct, and that I understand to be the precise object of all who have followed in his track. It was said of the Genevese theorist, "Le genre humain avait perdu ses titres; Jean-Jacques les a retrouvés" (the human race had lost its title-deeds; Jean-Jacques found them again); just as his intellectual progeny declare that the nation ought to "resume" the landed property of which it has, unfortunately, lost the title-deeds.

We are now in a position to consider what the chief of these principles of the gospel according to Jean-Jacques are:

1. All men are born free, politically equal, and good, and in the "state of nature" remain so; consequently it is their natural right to be free, equal, and (presumably, their duty to be) good.*

2. All men being equal by natural right, none can have any right to encroach on another's equal right. Hence no man can appropriate any part of the common means of subsistence—that is to say, the land or anything which the land produces—without the unanimous consent of all other men. Under any other circumstances, property is usurpation, or, in plain terms, robbery.†

3. Political rights, therefore, are based upon contract; the so-called right of conquest is no right, and property which has been acquired by force may rightfully be taken away by force.‡

and themselves with contradictions. To reduce this doctrine to the rules and infallibility of reason there is no way, but, first, put such principles down for a foundation, as passion, not mistrusting, may not seek to displace; and afterward to build thereon the truth of cases in the law of nature (which hitherto have been built in the air) by degrees, till the whole have been inexpugnable." However, it must be recollected that Hobbes does not start from *a priori* principles of ethics, but from the practical necessities of men in society.

* "Contrat Social," v, pp. 98, 99. The references here given are to the volumes and pages of Mussay Pathay's edition (1826). "Discours," *passim;* see especially p. 268.

† "Discours," pp. 257, 258–276. How many wild sermons have been preached on this text: "Ignorez-vous qu'une multitude de vos frères périt ou souffre du besoin de ce que vous avez de trop, et qu'il vous fallait un consentement exprès et unanime du genre humain pour vous approprier sur la subsistance commune tout ce qui alloit au-delà de la vôtre?" (Don't you know that a multitude of your brothers are perishing or suffering for the need of what you have too much of, and that you ought to have an express and unanimous consent of the human race before you appropriate to yourself from the common subsistence any more than you need for your own?)

‡ "Discours," pp. 276, 280; "Contrat," chap. iii.: "Telle fut ou dut être" (charming alternative!) "l'origine de la société et des lois, qui donnèrent de nouvelles entraves au foible et de nouvelles forces au riche, détruisirent sans retour la liberté naturelle, fixèrent pour jamais la loi de la propriété et de l'inégalité, d'une adroite usurpation firent un droit irrévocable, et, pour le profit de quelques ambitieux, assujettirent désormais tout le genre humain au travail, à la servitude et à la misère." (Such was or must have been the origin of society and of the laws which imposed new shackles on the weak man and gave new forces to the rich one, destroyed natural liberty without requital, established forever the law of property and inequality, made an irrevocable law of an adroit usurpation, and

I am bound to confess, at the outset, that, while quite open to conviction, I incline to think that the obvious practical consequences of these propositions are not likely to conduce to the welfare of society, and that they are certain to prove as injurious to the poor as to the rich. Due allowance must be made for the possible influence of such prejudice as may flow from this opinion upon my further conviction that, regarded from a purely theoretical and scientific point of view, they are so plainly and demonstrably false that, except for the gravity of their practical consequences, they would be ridiculous.

What is the meaning of the famous phrase that "all men are born free and equal,"* which gallicized Americans, who were as much "philosophes" as their inherited common sense and their practical acquaintance with men and with affairs would let them be, put forth as the foundation of the "Declaration of Independence"? I have seen a considerable number of new-born infants. Without wishing to speak of them with the least disrespect—a thing no man can do, without, as the proverb says, "fouling his own nest"—I fail to understand how they can be affirmed to have any political qualities at all. How can it be said that these poor little mortals who have not even the capacity to kick to any definite end, nor indeed to do anything but vaguely squirm and squall, are equal politically, except as all zeros may be said to be equal? How can little creatures be said to be "free" of whom not one would live for four-and-twenty hours if it were not imprisoned by kindly hands and coerced into applying its foolish, wandering mouth to the breast it could never find for itself? How is the being whose brain is still too pulpy to hold an idea of any description to be a moral agent either good or bad? Surely it must be a joke, and rather a cynical one too, to talk of the political status of a new-born child! But we may carry our questions a step further. If it is mere abracadabra to speak of men being born in a state of political freedom and equality, thus fallaciously confusing positive equality—that is to say, the equality of powers—with the equality of impotences; in what conceivable state of society is it possible that men should not merely be born, but pass through childhood and still remain free? Has a child of fourteen been free to choose its language and all the connotations with which words became burdened in their use by generation after generation? Has it been free to choose the habits enforced by precept and more surely driven home by example? Has it been free to invent its own standard of right and wrong? Or rather,

henceforth, for the profit of a few ambitious persons, subjected the whole human race to labor, servitude, and misery.)—("Discours," p. 278). Behold the quintessence of Rousseauism—method and results—with practical application, legible by the swiftest runner!

* ["All men are created equal" is the wording of the "Declaration."—EDITOR P. S. M.]

has it not been as much held in bondage by its surroundings and driven hither and thither by the scourge of opinion, as a veritable slave, although the fetters and the whip may be invisible and intangible?

Surely, Aristotle was much nearer the truth in this matter than Hobbes or Rousseau. And if the predicate "born slave" would more nearly agree with fact than "born free," what is to be said about "born equal"? Rousseau, like the sentimental rhetorician that he was, and half, or more than half, sham, as all sentimental rhetoricians are, sagaciously fought shy, as we have seen, of the question of the influence of natural upon political equality. But those of us who do not care for sentiment and do care for truth may not evade the consideration of that which is really the key of the position. If Rousseau, instead of letting his children go to the *infants trouvés*, had taken the trouble to discharge a father's duties toward them, he would hardly have talked so fast about men being born equal, even in a political sense. For, if that merely means that all new-born children are political zeros—it is, as we have seen, though true enough, nothing to the purpose; while, if it means that, in their potentiality of becoming factors in any social organization—citizens in Rousseau's sense—all men are born equal, it is probably the most astounding falsity that ever was put forth by a political speculator; and that, as all students of political speculation will agree, is saying a good deal for it. In fact, nothing is more remarkable than the wide inequality which children, even of the same family, exhibit, as soon as the mental and moral qualities begin to manifest themselves; which is earlier than most people fancy. Every family spontaneously becomes a polity. Among the children, there are some who continue to be "more honored and more powerful than the rest, and to make themselves obeyed" (sometimes, indeed, by their elders) in virtue of nothing but their moral and mental qualities. Here "political inequality" visibly dogs the heels of "natural" inequality. The group of children becomes a political body, a *civitas*, with its rights of property, and its practical distinctions of rank and power. And all this comes about neither by force nor by fraud, but as the necessary consequence of the innate inequalities of capability.

Thus men are certainly not born free and equal in natural qualities; when they are born, the predicates "free" and "equal" in the political sense are not applicable to them; and as they develop, year by year, the differences in the political potentialities with which they really are born, become more and more obviously converted into actual differences—the inequality of political faculty shows itself to be a necessary consequence of the inequality of natural faculty. It is probably true that the earliest men were

nomads. But among a body of naked, wandering savages, though there may be no verbally recognized distinctions of rank or office, superior strength and cunning confer authority of a more valid kind than that secured by acts of Parliament; there may be no property in things, but the witless man will be poverty-stricken in ideas, the clever man will be a capitalist in that same commodity, which in the long run buys all other commodities; one will miss opportunities, the others will make them; and, proclaim human equality as loudly as you like, Witless will serve his brother. So long as men are men and society is society, human equality will be a dream; and the assumption that it does exist is as untrue in fact as it sets the mark of impracticability on every theory of what ought to be, which starts from it.

And that last remark suggests that there is another way of regarding Rousseau's speculations. It may be pointed out that, after all, whatever estimate we may form of him, the author of works which have made such a noise in the world could not have been a mere fool; and that if, in their plain and obvious sense, the doctrines which he advanced are so easily upset, it is probable that he had in his mind something which is different from that sense.

I am a good deal disposed to think that this is the case. There is much to be said in favor of the view that Rousseau, having got hold of a plausible hypothesis, more or less unconsciously made up a clothing of imaginary facts to hide its real nakedness. He was not the first nor the last philosopher to perform this feat.

As soon as men began to think about political problems, it must have struck them that, if the main object of society was the welfare of its members (and until this became clear, political action could not have risen above the level of instinct),* there were all sorts of distinctions among men, and burdens laid upon them, which nowise contributed to that end. Even before the great leveler, Rome, had actually thrown down innumerable social and national party-walls, had absorbed all other forms of citizenship into her own, and brought the inhabitants of what was then known as the world under one system of obligations—thoughtful

* It is not to be forgotten that what we call rational grounds for our beliefs are often extremely irrational attempts to justify our instincts. I can not doubt that human society existed before language or any ethical consciousness. Gregarious animals form polities in which they act according to rules conducive to the welfare of the whole society, although, of course, it would be absurd to say that they obey laws in the juridical sense. The polities of the masterless dogs in Eastern cities are well known. And, in any street of an English town, one may observe a small dog chased by a bigger, who turns round the moment he has entered his own territory and defies the other; while, usually, after various manifestations of anger and contempt, the bigger withdraws. No doubt the small dog has had previous experience of the arrival of assistance under such circumstances, and the big one of the effects of sticks and stones and other odd missiles; no doubt the associations thus ingrained are the prime source of the practical acknowledgment of ownership on both sides. I suspect it has been very much the same among men.

men were discovering that it was desirable, in the interest of society, that all men should be as free as possible, consistently with those interests; and that they should all be equally bound by the ethical and legal obligations which are essential to social existence. It will be observed that this conclusion is one which might be arrived at by observation and induction from the phenomena of past and present experience. My belief is that it is the conclusion which must be reached by those means, when they are rightly employed—and that, in point of fact, the doctrines of freedom and equality, so far as they were preached by the Stoics and others, would have not the least success, if they had not been so far approved by experience and so far in harmony with human instincts that the Roman jurists found they could work them up with effect into practical legislation. For the *a priori* arguments of the philosophers in the last century of the republic, and the first of the empire, stand examination no better than those of the philosophers in the centuries before and after the French Revolution. As is the fashion of speculators, they scorned to remain on the safe if humble ground of experience, and preferred to prophesy from the sublime cloud-land of the *a priori;* so that, busied with deduction from their ideal "ought to be," they overlooked the "what has been," the "what is," and the "what can be."

It is to them that we owe the idea of living "according to nature"; which begot the idea of the "state of nature"; which begot the notion that the "state of nature" was a reality, and that, once upon a time, "all men were free and equal"—which again begot the theory that society ought to be reformed in such a manner as to bring back these halcyon days of freedom and equality; which begot *laissez faire* and universal suffrage; which begot the theory so dear to young men of more ambition than industry, that while every other trade, business, or profession requires theoretical training and practical skill, and would go to the dogs if those who carry them on were appointed by the majority of votes of people who know nothing about it and very little about them—the management of the affairs of society will be perfectly successful if only the people who may be trusted to know nothing will vote into office the people who may be trusted to do nothing.

If this is the political ideal of the modern followers of Rousseau, I, for my part, object to strive after it, or to do anything but oppose, to the best of my ability, those who would fain drive us that way. Freedom, used foolishly, and equality, asserted in words, but every moment denied by the facts of nature, are things of which, as it seems to me, we have rather too much already. If I mistake not, one thing we need to learn is the necessity of limiting individual freedom for the general good; and another, that although decision by a majority of votes may be as good a rough-

and-ready way as can be devised to get political questions settled, yet that, theoretically, the despotism of a majority is as little justifiable and as dangerous as that of one man; and yet another, that voting power, as a means of giving effect to opinion, is more likely to prove a curse than a blessing to the voters, unless that opinion is the result of a sound judgment operating upon sound knowledge. Some experience of sea-life leads me to think that I should be very sorry to find myself on board a ship in which the voices of the cook and the loblolly boys counted for as much as those of the officers, upon a question of steering, or reefing topsails; or where the "great heart" of the crew was called upon to settle the ship's course. And there is no sea more dangerous than the ocean of practical politics—none in which there is more need of good pilotage and of a single, unfaltering purpose when the waves rise high.

The conclusion of the whole matter, then, would seem to be that the doctrine that all men are, in any sense, or have been, at any time, free and equal, is an utterly baseless fiction. Nor does the proposition fare much better if we modify it, so as to say that all men ought to be free and equal, so long as the "ought" poses as a command of immutable morality. For, assuredly, it is not intuitively certain "that all men ought to be free and equal." Therefore, if it is to be justified at all *a priori*, it must be deducible from some proposition which is intuitively certain; and unfortunately none is forthcoming. For the proposition that men ought to be free to do what they please, so long as they do not infringe on the equal rights of other men, assumes that men have equal rights and can not be used to prove that assumption. And if, instead of appealing to philosophy, we turn to revealed religion, I am not aware that either Judaism or Christianity affirms the political freedom or the political equality of men in Rousseau's sense. They affirm the equality of men before God—but that is an equality either of insignificance or of imperfection.

With the demonstration that men are not all equal under whatever aspect they are contemplated, and that the assumption that they ought to be considered equal has no sort of *a priori* foundation—however much it may, in reference to positive law, with due limitations, be justifiable by considerations of practical expediency—the bottom of Rousseau's argument, from *a priori* ethical assumptions to the denial of the right of an individual to hold private property, falls out. For Rousseau, with more logical consistency than some of those who have come after him, puts the land and its produce upon the same footing. "Vous êtes perdus si vous oubliez que les fruits sont à tous, et que la terre n'est à personne," says he. (You are lost if you forget that the fruits are for all and the land is not for any one.)

From Rousseau's point of view, this is, in fact, the only rational conclusion from the premises. The attempt to draw a distinction between land, as a limited commodity, and other things as unlimited, is an obvious fallacy. For, according to him,* the total habitable surface of the earth is the property of the whole human race in common. Undoubtedly, the habitable and cultivable land amounts to a definite number of square miles, which, by no effort of human ingenuity, at present known or suspected, can be sensibly increased beyond the area of that part of the globe which is not covered by water; and therefore its quantity is limited. But if the land is limited, so is the quantity of the trees that will grow on it; of the cattle that can be pastured on it; of the crops that can be raised from it; of the minerals that can be dug from it; of the wind; and of the water-power, afforded by the limited streams which flow from the limited heights. And, if the human race were to go on increasing in number at its present rate, a time would come when there would not be standing-ground for any more; if it were not that, long before that time, they would have eaten up the limited quantity of food-stuffs and died like the locusts that have consumed everything eatable in an oasis of the desert. The attempt to draw a distinction between land as limited in quantity, in the sense, I suppose, that it is something that can not be imported—and other things as unlimited, because they can be imported—has arisen from the fact that Rousseau's modern followers entertain the delusion that, consistently with their principles, it is possible to suppose that a nation has right of ownership in the land it occupies. If the island of Great Britain is the property of the British nation, then, of course, it is true that they can not have more than somewhere about ninety thousand square miles of land, while the quantity of other things they can import is (for the present, at any rate), practically, if not strictly, unlimited. But how is the assumption that the Britons own Britain, to be reconciled with the great dictum of Rousseau, that a man can not rightfully appropriate any part of this limited commodity, land, without the unanimous consent of all his fellow-men? My strong impression is that if a party-colored *plébiscite* of Europeans, Chinese, Hindoos, negroes, red Indians, Maoris, and all the other inhabitants of the terrestrial globe were to decree us to be usurpers, not a soul would budge; and that, if it came to fighting, Mr. Morley's late "hecklers" might be safely depended upon to hold their native soil against all intruders, and in the teeth of the most absolute of ethical politicians, even though he should prove from Rousseau—

> Exceedingly well
> That such conduct was quite atrocious.

* As to Hobbes, but on different grounds.

Rousseau's first and second great doctrines having thus collapsed, what is to be said to the third?

Of course, if there are no rights of property but those based on contract, conquest, that is to say, taking possession by force, of itself can confer no right. But, as the doctrine that there are no rights of property but those based on the consent of the whole human race—that is, that A. B. can not own anything unless the whole of mankind formally signify their assent to his ownership—turns out to be more than doubtful in theory and decidedly inconvenient in practice, we may inquire if there is any better reason for the assertion that force can confer no right of ownership. Suppose that, in the old seafaring days, a pirate attacked an East Indiaman—got soundly beaten and had to surrender. When the pirates had walked the plank or been hanged, had the captain and crew of the East Indiaman no right of property in the prize—I am not speaking of mere legal right, but ethically? But if they had, what is the difference when nations attack one another; when there is no way out of their quarrel but the appeal to force, and the one that gets the better seizes more or less of the other's territory and demands it as the price of peace? In the latter case, in fact, we have a contract, a price paid for an article—to wit, peace—delivered, and certain lands taken in exchange; and there can be no question that the buyer's title is based on contract. Even in the former alternative, I see little difference. When they declared war, the parties knew very well that they referred their case to the arbitrament of force; and if contracts are eternally valid, they are fully bound to abide by the decision of the arbitrator whom they have elected to obey. Therefore, even on Hobbes's or Rousseau's principles, it is not by any means clear to my mind that force, or rather the state of express or tacit contract which follows upon force successfully applied, may not be plausibly considered to confer ownership.

But if the question is argued, as I think it ought to be, on empirical grounds—if the real question is not one of imagined *a priori* principle, but of practical expediency—of the conduct which conduces most to human welfare—then it appears to me that there is much to be said for the opinion that force effectually and thoroughly used, so as to render further opposition hopeless, establishes an ownership* which should be recognized as soon as possible. I am greatly disposed to think, that when ownership established by force has endured for many generations, and all sorts of contracts have been entered into on the faith of such ownership, the attempt to disturb it is very much to be deprecated on all grounds. For the welfare of society, as for that of individual

* Submission to the Revolution of 1688 by Jacobites could be advocated ethically on no other ground, though all sorts of pretexts were invented to disguise the fact.

men, it is surely essential that there should be a statute of limitations in respect of the consequences of wrong-doing. As there is nothing more fatal to nobility of personal character than the nursing of the feeling of revenge—nothing that more clearly indicates a barbarous state of society than the carrying on of a *vendetta*, generation after generation—so I take it to be a plain maxim of that political ethic which does not profess to have any greater authority than agreeableness to good feeling and good sense can confer, that the evil deeds of former generations—especially if they were in accordance with the practices of a less advanced civilization, and had the sanction of a less refined morality—should, as speedily as possible, be forgotten and buried under better things.

"Musst immer thun wie neu geboren" (must ever do as if new-born) is the best of all maxims for the guidance of the life of states, no less than of individuals. However, I express what I personally think, in all humility, in the face of the too patent fact that there are persons of light and leading—with a political authority to which I can make not the remotest pretension, and with a weight of political responsibility which I rejoice to think can never rest on my shoulders—who by no means share my opinion, but who, on the contrary, deem it right to fan the sparks of revenge which linger among the embers of ancient discords; and to stand between the dead past and the living present, not with the healing purpose of the Jewish leader, but rather to intensify the plague of political strife, and hold aloft the brazen image of the father's wrongs, lest the children might perchance forget and forgive.

However, the question whether the fact that property in land was originally acquired by force invalidates all subsequent dealings in that property so completely, that no lapse of time, no formal legalization, no passing from hand to hand by free contract through an endless series of owners, can extinguish the right of the nation to take it away by force from the latest proprietor, has rather an academic than a practical interest, so long as the evidence that landed ownership did so arise is wanting. Potent an organon as the *a priori* method may be, its employment in the region of history has rarely been found to yield satisfactory results; and, in this particular case, the confident assertions that land was originally held in common by the whole nation, and that it has been converted into severalty by force, as the outcome of the military spirit rather than by the consent, or contract, characteristic of industrialism, are singularly ill-founded.

Let us see what genuine history has to say to these assertions. Perhaps it might have been pardonable in Rousseau to propound

such a statement as that the primitive land-owner was either a robber or a cheat; but, in the course of the century and a half which has elapsed since he wrote, and especially in that of the last fifty years, an immense amount of information on the subject of ancient land-tenure has come to light; so that it is no longer pardonable, in any one, to content himself with Rousseau's ignorance. Even a superficial glance over the results of modern investigations into anthropology, archæology, ancient law, and ancient religion, suffices to show that there is not a particle of evidence that men ever existed in Rousseau's state of nature, and that there are very strong reasons for thinking that they never could have done so, and never will do so.

It is, at the least, highly probable that the nomadic preceded any other social state; and, as the needs of a wandering hunter's or pastor's life are far more simple than any other, it follows that the inequalities of condition must be less obvious among nomads than among settled people. Men who have no costume at all, for example, can not be said to be unequally clothed; they are, doubtless, more equal than men some of whom are well clothed and others in rags, though the equality is of the negative sort. But it is a profound mistake to imagine that, in the nomadic condition, any more than in any other which has yet been observed, men are either "free" or "equal" in Rousseau's sense. I can call to mind no nomadic nation in which women are on an equality with men; nor any in which young men are on the same footing as old men; nor any in which family groups, bound together by blood ties, by their mutual responsibility for bloodshed and by common worship, do not constitute corporate political units, in the sense of the city* of the Greeks and Romans. A "state of nature" in which noble and peaceful, but nude and propertyless, savages sit in solitary meditation under trees, unless they are dining or amusing themselves in other ways, without cares or responsibilities of any sort, is simply another figment of the unscientific imagination. The only uncivilized men of whom anything is really known are hampered by superstitions and enslaved by conventions, as strange as those of the most artificial societies, to an almost incredible degree. Furthermore, I think, it may be said with much confidence that the primitive "land-grabber" did not either force or cheat his co-proprietors into letting him fence in a bit of the land which hitherto was the property of all.

The truth is, we do not know, and probably never shall know completely, the nature of all the various processes by which the ownership of land was originally brought about. But there is

* I may remind the reader that, in their original senses, πόλις and *civitas* mean, not an aggregation of houses, but a corporation. In this sense, the City of London is formed by the freemen of the city, with their common councilors, aldermen, and lord mayor.

excellent ground for sundry probable conclusions* : in the fact that almost all parts of the world, and almost all nations, have yielded evidence that, in the earliest settled condition we can get at, land was held as private or several property, and not as the property of the public, or general body of the nation. Now private or several property may be held in one of two ways. The ownership may be vested in a single individual person, in the ordinary sense of that word; or it may be vested in two or more individuals forming a corporation or legal person; that is to say, an entity which has all the duties and responsibilities of an individual person, but is composed of two or more individuals. It is obvious that all the arguments which Rousseau uses against individual land-ownership apply to corporate land-ownership. If the rights of A, B, and C are individually *nil*, you can not make any more of your 0 by multiplying it by 3. (A, B, C)—the corporation—must be a usurper if A, B, and C, taken each by himself, is so. Moreover, I think I may take it for granted that those who desire to make the state universal land-owner would eject a corporation from its estates with even less hesitation than they would expel an individual.

The particular method of early land-holding of which we have the most wide-spread traces is that in which each of a great number of moderate-sized portions of the whole territory occupied by a nation is held in complete and inalienable ownership† by the males of a family, or of a small number of actual or supposed kindred families, mutually responsible in blood feuds, and worshiping the same God or Gods. No female had any share in the ownership of the land. If she married outside the community, she might take a share of the movables; and, as a rule, she went to her husband's community. If, however, the community was short of hands, the husband might be taken into it, and then he acquired all the rights and responsibilities of the other members. Children born in the community became full members of it by domicile, so to speak, not by heredity from their parents. This primitive "city" was lodged in one or more dwellings, each usually standing in a patch of inclosed ground; of arable land in the immediate neighborhood of the dwellings; while pasture and uncleared forest land lay outside all. Each commune was as jealous of its rights of ownership as the touchiest of squires; but, so long as the population was as scanty in proportion to the occupied territory as was usually the case in ancient times, the communities got along pretty peaceably with one another. Any notion that all

* For the difficulties which attach to the establishment of such probable conclusions, see the remarkable work of M. Fustel de Coulanges, "Recherches sur quelques problèmes d'Histoire: Les Germains."

† Inalienable, that is, without the consent of the whole owning community.

the communities which made up the nation had a sort of corporate overlordship over any one, still more that all the rest of the world had any right to complain of their "appropriation of the means of subsistence," most assuredly never entered the heads of our forefathers. But, alongside this corporate several ownership, there is strong ground for the belief that individual ownership was recognized, to a certain extent, even in these early times. The inclosure around each dwelling was understood to belong to the family inhabiting the dwelling; and, for all practical purposes, must have been as much owned by the head of it as a modern entailed estate is owned by the possessor for the time being. Moreover, if any member of the community chose to go outside and clear and cultivate some of the waste, the reclaimed land was thenceforth recognized as his—that is to say, the right of ownership, in virtue of labor spent, was admitted.*

Thus it is obvious that, though the early land-holders were, to a great extent, collective owners, the imaginary rights of mankind to universal land-ownership, or even of that of the nation at large to the whole territory occupied, were utterly ignored; that, so far from several ownership being the result of force or fraud, it was the system established with universal assent; and that, from the first, in all probability, individual rights of property, under certain conditions, were fully recognized and respected. Rousseau was, therefore, correct in suspecting that his "state of nature" had never existed—it never did, nor anything like it. But it may be said, supposing that all this is true, and supposing that the doctrine that Englishmen have no right to their appropriation of English soil is nonsense; it must, nevertheless, be admitted that, at one time, the great body of the nation, consisting of these numerous land-owning corporations, composed of comparatively poor men, did own the land. And it must also be admitted that now they do not; but that the land is in the hands of a relatively small number of actually or comparatively rich proprietors, who constitute perhaps not one per cent of the population. What is this but the result of robbery and cheating? The descendants of the robbers and cut-throat soldiers who came over with William of Normandy have been true to their military instincts, and have "conveyed" the property of the primitive corporations into their own possession. No doubt, that is history made easy; but here, once more, fact and *a priori* speculations can not be made to fit.

Let us look at the case dispassionately, and by the light of real history. No doubt, the early system of land-tenure by collective several ownership was excellently adapted to the circumstances in which mankind found themselves. If it had not been so, it would

* Rousseau himself not only admits but insists on the validity of this claim in the "Contrat Social," liv. i, chap. ix.

not have endured so long, nor would it have been adopted by all sorts of different races—from the ancient Irish to the Hindoos, and from the Russians to the Caffres and Japanese. These circumstances were in the main as follows: that there was plenty of land unoccupied; that population was very scanty and increased slowly; that wants were simple; that people were content to go on living in the same way, generation after generation; that there was no commerce worth speaking of; that manufactures were really that which they are etymologically—things made by the hands; and that there was no need of capital in the shape of money. Moreover, with such methods of warfare as then existed, the system was good for defense, and not bad for offense.

Yet, even if left to itself, to develop undisturbedly, without the intrusion of force, fraud, or militarism in any shape, the communal system, like the individual-owner system or the state-owner system, or any other system that the wit of man has yet devised, would sooner or later have had to face the everlasting agrarian difficulty. And the more the communities enjoyed general health, peace, and plenty, the sooner would the pressure of population upon the means of support make itself felt. The difficulty paraded by the opponents of individual ownership, that, by the extension of the private appropriation of the means of subsistence, the time would arrive when men would come into the world for whom there was no place, must needs make its appearance under any system, unless mankind are prevented from multiplying indefinitely. For, even if the habitable land is the property of the whole human race, the multiplication of that race must, as we have seen, sooner or later, bring its numbers up to the maximum which the produce can support; and then the interesting problem in casuistry, which even absolute political ethics may find puzzling, will arise: Are we, who can just exist, bound to admit the new-comers who will simply starve themselves and us? If the rule that any one may exercise his freedom only so far as he does not interfere with the freedom of others is all-sufficient, it is clear that the new-comers will have no rights to exist at all, inasmuch as they will interfere most seriously with the freedom of their predecessors. The population question is the real riddle of the sphinx, to which no political Œdipus has as yet found the answer. In view of the ravages of the terrible monster over-multiplication, all other riddles sink into insignificance.

But to return to the question of the manner in which individual several ownership has, in our own and some other countries, superseded communal several ownership. There is an exceedingly instructive chapter in M. de Laveleye's well-known work on "Primitive Property," entitled "The Origin of Inequality

in Landed Property." And I select M. de Laveleye as a witness the more willingly, because he draws very different conclusions from the facts he so carefully adduces to those which they appear to me to support.

After enumerating various countries in which, as M. de Laveleye thinks, inequality and an aristocracy were the result of conquest, he asks very pertinently:

> But how were they developed in such countries as Germany, which know nothing of conquerors coming to create a privileged caste above a vanquished and enslaved population? Originally we see in Germany associations of free and independent peasants like the inhabitants of Uri, Schwyz, and Unterwalden at the present day. At the close of the middle ages we find, in the same country, a feudal aristocracy resting more heavily on the soil, and a rustic population more completely enslaved than in England, Italy, or France (p. 222).

The author proceeds to answer the question which he propounds by showing, in the first place, that the admission of the right of individuals and their heirs to the land they had reclaimed, which was so general, if not universal, created hereditary individual property alongside the communal property, so that private estates arose in the waste between the sparse communal estates. Now, it was not every family or member of a community that was enterprising enough to go out and clear waste lands, or that had the courage to defend its possessions when once obtained. The originally small size of the domains thus acquired, and the strong stimulus of personal interest, led to the introduction of better methods of cultivation than those traditional in the communes. And, finally, as the private owner got little or no benefit from the community, he was exempted from the charges and *corvées* laid upon its members. The result, as may be imagined, was that the private proprietors, aided by serf-labor, prospered more than the communities cultivated by their free members, seriously hampered them by occupying fresh waste lands, yielded more produce, and furnished wealth, which, with the help of the *majorat* system, remained concentrated in the hands of owners who, in virtue of their possessions, could maintain retainers; while, freed from the need to labor, they could occupy themselves with war and the chase, and, as nobles, attend the sovereign. On the other hand, their brethren, left behind in the communes, had little chance of growing individually rich or powerful, and had to give themselves up to agricultural toil. The Bishop of Oxford, in his well-known "Constitutional History of England" (vol. i, p. 51), puts the case, as his wont is, concisely and precisely: "As the population increased, and agriculture itself improved, the mark system must have been superseded everywhere." No doubt, when the nobles had once established themselves, they often added force and fraud to their other means

of enlarging their borders. But, to begin with, the inequality was the result, not of militarism, but of industrialism. Clearing a piece of land for the purpose of cultivating it and reaping the crops for one's own advantage is surely an industrial operation, if ever there was one.

Secondly, M. de Laveleye points out that the Church was a great devourer of commune lands:

"We know that a member of the commune could only dispose of his share with the consent of his associates, who had a right of resumption; but this right could not be exercised against the Church. Accordingly, in these days of religious fervor, the faithful frequently left to the Church all that they possessed, not only their house and its inclosure, but the undivided share in the *mark* attached to it" (p. 225). Thus an abbot, or a bishop, became co-proprietor with the peasants of a commune; and, with such a cuckoo in the nest, one can conceive that the hedge-sparrows might have a bad time. "Already by the end of the ninth century one third of the whole soil of Gaul belonged to the clergy" (p. 225). But, if the men who left their property to the Church believed that they got their *quid pro quo* in the shape of masses for their souls, as they certainly did; and if the churchmen believed as sincerely (and they certainly did) that they gave valuable consideration for the property left them, where does fraud come in? Is it not again a truly industrial operation? Indeed, a keen-witted and eminent Scotch judge once called a huge bequest to a church "fire insurance," so emphatically commercial did the transaction appear to him.

Thirdly, personal several property was carved out of the corporate communal property in another fashion, to which no objection can be taken by industrialism. Plots of arable land were granted to members of the commune who were skilled artificers, as a salary for their services. The craft transmitting itself from father to son, the land went with it and grew into an hereditary benefice.

Fourthly, Sir Henry Maine* has proved in a very striking manner, from the collection of the Brehon laws of ancient Ireland, how the original communal land-ownership of the sept, with the allotment of an extra allowance of pasture to the chief, as the honorarium for his services of all kinds, became modified, in consequence of the power of keeping more cattle than the rest of the sept, thus conferred on the chief. He became a lender of cattle at a high rate of interest to his more needy sept fellows, who when they borrowed became bound to do him service in other ways and lost status by falling into the position of his debtors. Hence the chief gradually acquired the characteristics of what naturalists

* See "Early History of Institutions," epecially Lecture vi.

have called "synthetic" and "prophetic" types, combining the features of the modern gombeen-man with those of the modern rack-renting landlord, who is commonly supposed to be a purely imported Norman or Saxon product, saturated with the very spirit of industrialism — namely, the determination to get the highest price for an article which is to be had. As a fact, the condition of the native Irish, under their own chiefs, was as bad in Queen Elizabeth's time as it has ever been since. Again, the status of the original commoners of the sept was steadily altered for the worse by the privilege which the chief possessed, and of which he freely availed himself, of settling on the waste land of the commune such broken vagabonds of other tribes as sought his patronage and protection, and who became absolutely dependent upon him. Thus, without war and without any necessity for force or fraud (though doubtless there was an adventitious abundance of both), the communal system was bound to go to pieces, and to be replaced by individual ownership, in consequence of the operation of purely industrial causes. That is to say, in consequence of the many commercial advantages of individual ownership over communal ownership; which became more and more marked exactly in proportion as territory became more fully occupied, security of possession increased, and the chances of the success of individual enterprise and skill as against routine, in an industrial occupation, became greater and greater.

The notion that all individual ownership of land is the result of force and fraud appears to me to be on a level with the peculiarly short-sighted prejudice that all religions are the results of sacerdotal cunning and imposture. As religions are the inevitable products of the human mind, which generates the priest and the prophet as much as it generates the faithful; so the inequality of individual ownership has grown out of the relative equality of communal ownership in virtue of those natural inequalities of men which, if unimpeded by circumstances, can not fail to give rise quietly and peaceably to corresponding political inequalities.

The task I have set myself is completed, as far as it can be within reasonable limits. I trust that those who have taken the trouble to follow the argument will agree with me that the gospel of Jean-Jacques, in its relation to property, is a very sorry affair—that it is the product of an untrustworthy method, applied to assumptions which are devoid of foundation in fact; and that nothing can be more profoundly true than the saying of the great and truly philosophical English jurist, whose recent death we all deplore, that speculations of this sort are rooted in "impatience of experience, and the preference of *a priori* to all other methods of reasoning."

Almost all the multitudinous causes which concurred in bringing about the French Revolution are happily absent in this country; and I have not the slightest fear that the preaching of any amount of political fallacy will involve us in evils of the magnitude of those which accompanied that great drama. But, seeing how great and manifold are the inevitable sufferings of men; how profoundly important it is that all should give their best will and devote their best intelligence to the alleviation of those sufferings which can be diminished, by seeking out, and, as far as lies within human power, removing their causes; it is surely lamentable that they should be drawn away by speculative chimeras from the attempt to find that narrow path which for nations, as for individual men, is the sole road to permanent well-being.—*Nineteenth Century.*

SLOYD: ITS AIM, METHOD, AND RESULTS.

By FRIMANN B. ARNGRIMSSON.

SLÖJD, anglicized into *sloyd*, is a Swedish word, meaning dexterity or manual skill (compare old Norse *sldegd*, cunning, and English *sly*). Of late, however, the word has been restricted to denote a system of manual training.

This system came originally from Finland, but was adopted some fifteen years ago in Sweden, and there perfected in its methods. The Finnish teacher Zygnaus is its originator; but to Messrs. A. Abrahamson and O. Salomon,* of Nääs, Sweden, is due the honor of having adapted it to the use of schools and made it generally known. For fifteen years their institute has been growing in importance, and in that time over one thousand teachers have been trained there and sent out to different parts of the world. Hence this method has often been called the Nääs system of manual training.

The *aim* of the system is not to teach the pupil a trade, but to educate him. Its primary object is to insure a healthy physical and mental development, while its secondary object is to secure general dexterity useful in every vocation.

The *method* is based upon the principle that a harmonious mental development is best secured through a harmonious physical development, promoted by exercise. It proceeds first to call the physical activities into play, and by stimulating, strengthening, and training these, it seeks to awaken, develop, and cultivate the powers of the mind. Taking advantage of the pupil's

* For more detailed accounts of the Sloyd system, consult the writings of Dr. O. Salomon, Miss C. Lord, Prof. W. T. Harris, P. M. Sluys, etc.

natural activity, it permits him to engage in work so arranged as to lead him to discover the principles to be taught, to apply his knowledge, and thus obtain a useful training.

The instruction is on the inductive plan, mainly through practical exercises, but in part oral. Class instruction is used only when general directions must be given, as when commencing a class, explaining the use of tools, position, etc. Otherwise, individual instruction is employed, it being found to yield the best results; but, as the pupil advances, the teacher's aid becomes less necessary.

The training consists mainly in performing certain exercises calculated to give general dexterity, promote health and strength, and at the same time develop the perceptive faculties, ingenuity of construction, concentrated attention, love of exactness, and artistic taste.

The exercises, though necessarily varying with the requirements of different localities, must embody the leading principles of the system; be conducive to health and development; pleasing, so as to interest the pupil; varied, so as to exercise the various faculties; and graded, so that the pupil may, with the mere guidance of the teacher, pass from the first and simplest to the last and most difficult.

Series of objects or models made of wood (Figs. 1 and 2) are used to illustrate the exercises. These models, though varying according to localities, must always represent useful articles; be of pleasing forms, in which curved lines largely enter; be varied, so as to demand variety of skill; and be systematically arranged, so that each subsequent model requires an exact copy of the preceding. All careless work must be excluded, as also polishing and painting, in order to secure the more thorough workmanship. The tools comprise all the essential ones used in carpentry—as the knife, the hammer, the center-bit, the try-square, compasses, saws, files, planes, etc. The work-room must be spacious, airy, and well lighted, and the work-benches should turn, so that when the pupil is at work the light shall fall on him chiefly from the left side. The teaching should not be intrusted to others than those who have natural qualifications for the work, have been instructed in the science of education, and trained in the system of Sloyd.

The courses of instruction must necessarily depend on circumstances, but the instruction falls naturally into three stages, viz., an elementary, an intermediate, and an advanced course; or, more simply, into an elementary course for children, and an advanced course for older pupils. In any case the period of instruction may be made to coincide with that of the common school.

What relation Sloyd bears to other systems of manual training

can here be merely indicated in a very general way. This system agrees with other systems of manual training in making physical exercise the basis of its instruction and training, also in adopting the inductive method of teaching. But it differs from most of these in using wood as the only material for construction, and in the form of its models. From the various handicrafts in wood, as carpentry, wood-carving, wood-engraving, etc., it differs in not

FIG. 1.—MODELS.

being a trade; and from other Sloyd systems, in avoiding their tendency of either aiming at a mere technical skill or a mere mental discipline. Thus, it differs from those adopted in France and Denmark in being less technical, from those in Germany in being less theoretical, and from the Russian system chiefly in laying greater stress on the utility of the articles and introducing curved lines at an earlier stage.

How far Sloyd may be adopted in the public schools has been extensively discussed in Europe. That it should be introduced into the public schools, either as a separate branch of study or incorporated with the ordinary branches as a continuation of the Kindergarten system, has been earnestly urged by some schools of pedagogy, and as strenuously opposed by others. It is not possible to enter fully into the subject here; but it may be noted that

the principal teacher of Sloyd, Director Salomon, unhesitatingly claims that its introduction into the public schools would be beneficial, directly promoting general health, and indirectly by facilitating the acquisition of other studies.

It has been claimed by many advocates of this system that it is better than most others, supplies a healthful training, without becoming on the one hand a mere trade, or on the other a mere theoretic study; that while it trains in general dexterity and promotes physical development, it at the same time strengthens and disciplines the faculties of the mind; cultivating the perceptives,

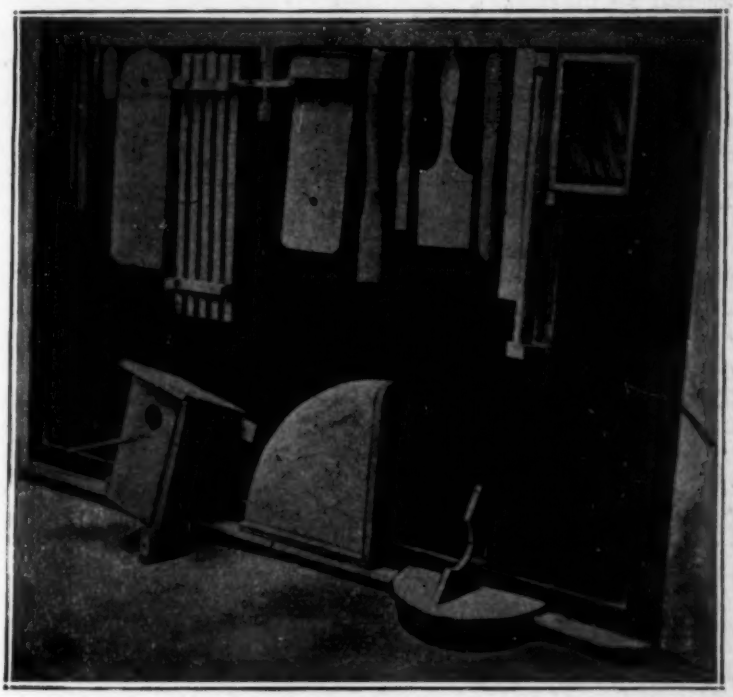


FIG. 2.—MODELS.

especially the senses of form and order; training the power of comparison, constructiveness, and concentration of thought; besides awakening a liking for manual labor, respect for manual workers, love for the true, and taste for the beautiful. Whatever may be said to the contrary, so much is certain that, if properly taught, Sloyd is a valuable means to education and an important complement to the ordinary branches of school studies. This is borne out by its phenomenal success in Sweden, its extensive adoption in countries where education is most advanced, as in Germany, France, and Great Britain, and by its growing popularity on this side of the Atlantic.

Some idea of how Sloyd is succeeding on this continent may be gleaned from the following extract from the "Midsummer Report of the Sloyd School" at No. 10 Warrenton Street, Boston:

"This school was started by Mrs. Quincy A. Shaw. It is superintended by Mrs. F. S. Fiske. The Sloyd instruction is given by Mr. G. Larsson, formerly a teacher in the normal school at Nääs, Sweden.

"The school began in November, 1888, in the Warrenton Street Chapel, the intention being to show the principles of the Swedish method of manual training—modified, however, according to American requirements. The course from November 1, 1888, to July 1, 1889, has been carried on with continually growing interest on the part of the pupils. As the course has been free, with no obligatory attendance whatever, it is astonishing to see with what interest and attention it has been followed, not only by the grown-up pupils, but especially by the younger ones.

"The number of pupils who have received instruction is above one hundred and forty; of these, fifty-three were lady teachers, twenty working-girls, thirty-seven boys between the ages of ten and sixteen years, ten young men, and twenty from the Horace Mann School (deaf and dumb).

"About fifty of the pupils have begun the normal course, but the time has been too short for any of these to finish the series.

"The pupils have to complete a copy of each model as exactly as possible before they begin the next number.

"As soon as they have completed the series, they will have a few lessons in sharpening tools; also get practice in teaching pupils; and by short discussion obtain some knowledge of the different systems of manual training in wood, their advantages, disadvantages, etc."

Since this report was written the school has steadily increased, so that now the pupils number over two hundred. Of these about eighty are boys, the rest being chiefly teachers from the city schools. There are two courses provided, and a third more advanced course will be added if necessary. The time required for completing a course varies from one hundred and fifty to two hundred hours, according to the pupil's ability. The pupils are divided into classes of twenty each, and these meet at stated times, generally twice a week, the lessons being usually of two hours' duration. Admission to the school is limited to teachers, boys from the public schools, and deaf-mutes from the Horace Mann School. Tuition is free.

The following table of the first six models, in a series of twenty-five, shows that the order of the exercises is the essential quality of a series of models:

No.	Model.	New exercises.	New tools.	Kind of wood.	Dimensions—ins.	Drawing.
1	Wedge.	Whittling.	Knife, rule, lead-pencil.	Pine.	3 × 1 × ½	Parallel lines.
2	Flower-pin.	Square whittling.	Knife, rule, and lead-pencil.	Pine.	12 × ¼	Parallel lines.
3	Flower-stick.	Square sawing and planing.	Splitting-saw, jack-plane, try-square, and marking-gauge.	Pine.	15 × ¼	How to find the
4	Pen-holder.	Curved whittling and boring.	Center-bit.	Hard pine.	8 × ¼	Free-hand drawing of curved lines.
5	Cutting-board.	Round sawing, filing, and using of block-plane.	Cross-cut saw, turning saw, compasses, flat file, block-plane, center-bit and back-saw.	Pine or white-wood.	17 × 6 × ½	How to find the center of a line; to draw a circle, given the radius or two tangents.
6	Flower-pot stand.	Nailing and using of bench-hook.	Hammer and bench-hook.	Pine.	20 × 6 × ½	Continued elem'n-tary drawing.

A GLIMPSE OF THE SLOYD SCHOOL IN BOSTON.—It is a rather remarkable building, that chapel at No. 10 Warrenton Street. The first floor is used for Kindergarten and evening school, the second for a church and lecture-room, while on the third floor is a Sloyd school.

Here the visitor enters a large, well-lighted hall (Fig. 3), with two rows of benches along the sides, and at each bench is a student. It may be that a class of teachers is at work, teachers mature in years and experience, of delicate frames, care-worn countenances, watchful eyes, aquiline noses, now and then adorned with a pair of gold spectacles—gentlemen, men of polite address, ladies of queenly deportment—all at present whittling or hammering, sawing or planing, like genuine carpenters, exercising many a delicate muscle now perhaps for the first time in their lives, working with a will, even enthusiasm, which can not be explained on the supposition that they are trying to atone for the sins of their quondam educators. No, they are here to educate themselves, that they may the better educate those placed in their charge; and it is this which makes their work sublime, even sacred. Or it may happen that a class of youths are at work—boys from the public schools or the machine-shops, factory-girls and servant-girls; youths who feel the irksome and unhealthy influence of hard service, who are debarred by utter poverty, arrogant pride, or blind custom, from obtaining that education which their gentle, aspiring, and noble natures desire—debarred from the full development and the free exercise of their God-given faculties; youths of untutored talents as well as those of well-instructed minds are here. And all engage in the work; all take hold with a will, even with joy. For they feel the blood course more freely in their veins, hear the wind breathe sweeter music, and see the light

weave a more lovely world of colors. Their dormant energies are awakened, the heightened color on the cheek, the lustrous laughing eye, the merry mobile lip, the fair white hand, the whole person speaks in eloquent language the pleasure which springs from progress, or a work well done.

FIG. 3.—FREE SLOYD SCHOOL—NORMAL CLASS.

But it may be that neither mature teachers nor tender youths are at their benches, but playful, frolicsome children flitting about their work like butterflies about a flower, and working with glee, learning almost unconsciously. Here is a batch of boys, there a group of girls, who at other times might be called a little unruly; they are now all attention, their minds concentrated on the curious models before them; and, while the exercise lasts, there is no indication of unrestrained spirits.

But perhaps the school presents none of these sights, but a very different one; a sight half sad, yet not without a ray of gladness; a picture not composed of trained teachers, or boisterous youths, or prattling children, eagerly listening, and as eagerly speaking, but of a group of deaf and dumb. And now, if ever, you may see what intense enthusiasm may be thrown into manual training. The poor unfortunates deprived of hearing and of speech find here a new field in which to exercise their minds and express their ideas. By their very disabilities they are enabled to concentrate

their minds better than their more fortunate brethren, and even outstrip them in excellence of workmanship. Among the boys there is a deaf-mute some sixteen years of age who surpasses all others in the school, a result attained not by superior talent but by close application. Near him another boy of magnificent build and great ability dashes off his work—now planing, now carving, with a master hand. On the other side of the room, in the midst of that row of girls—neat, even pretty girls—there are two most noticeable; one a brunette, whose quick, observant eye omits nothing while her snow-white hand deftly draws and carefully carves the model. Beside her stands a quiet blonde with blue, thoughtful eyes, carefully examining her model; and then, as if suddenly discovering some new principle, makes a gesture of joy and resumes her work. At the close of the exercise she takes the finished model to her teacher, and, with a pleasant smile, joyful feelings struggling for expression in her soulful face, says, in the deaf-mute language, "I love this work."

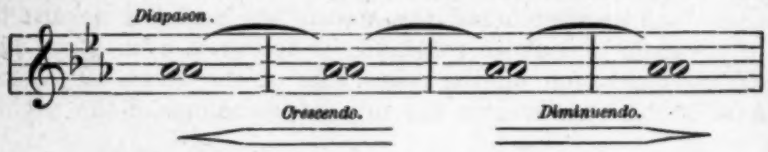
THE MYSTERIOUS MUSIC OF PASCAGOULA.

By CHARLES E. CHIDSEY.

ANY one examining a map of the Mississippi coast will find indicated thereon, about one hundred miles east of New Orleans, the town of Scranton, or East Pascagoula, situated at the mouth of the Pascagoula River. The waters of this river have become famous in "song and story" for the strange sounds which they give forth as they slowly make their way to the Gulf. For forty years or more a great deal has been written in prose and verse about this mysterious music of Pascagoula, yet no one that I know of has ever attempted to give an accurate description or a plausible explanation of the phenomenon. In the following paper it is my purpose to describe the sounds as I have often heard them, and for an explanation of the mystery to give a theory, long since advanced by Darwin and Rev. Charles Kingsley, to explain the cause of similar music heard on the southern coast of France.

It was late one evening in September, 1875, that I first heard the mysterious music of Pascagoula. An old fisherman called me from the house where I then was, to come down on the river-bank and "hear the spirits singing under the water." Full of eager curiosity, I readily obeyed the summons, and, if what I heard can not be properly called music, it was certainly mysterious. From out of the waters of the river, apparently some forty feet

from its shelving bank, rose a roaring, murmuring sound, which gradually increased in strength and volume, until it had reached its height, when it as slowly descended. It may be represented as follows:



It never advanced or receded, but seemed always in the same spot; and, though I remained there some time, it never ceased, but continued to rise and fall in the manner that I have indicated above. The reader may obtain a better idea of the music if he will place his ear against a telegraph-pole, the timber of which, acting as a sounding-board for the wires that are played upon by the wind, gives forth a strange, tremulous sound, that is an exact counterpart of the "music of Pascagoula"—with this difference, however, that whereas the music of the wires is very wavering and tremulous, that of the water rises and falls with a steady swell.

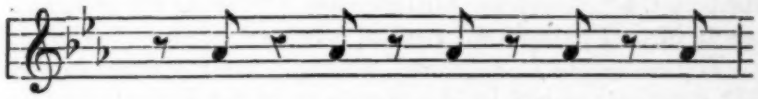
One evening in October, some years after the event above mentioned, while seated on an old wharf on the banks of the Pascagoula River, idly watching the ever varying and shifting hues of the setting sun, pointing with my finger across the wide extent of marsh that stretched before me to a squall that was raging in the Gulf, I remarked to my companion how distinctly we could hear the roar of the wind, though the storm was so far off. "That," she replied, "is not the storm that you hear, but the mysterious music." Approaching the edge of the wharf upon which we sat, and leaning over, I soon ascertained the truth of her words, for from out of the water came a roaring, rushing sound like that of a mighty wind, that may be represented thus:

The sound, however, was not caused by the wind passing between the wharf and the water, as there was very little breeze where we were, and, though I visited the spot some time afterward, it abated but little. I have been frequently told by fishermen that, when fishing at night on the waters of the Pascagoula, should they hear the mysterious music and make an unusual sound by splashing the water with an oar, or jumping overboard,

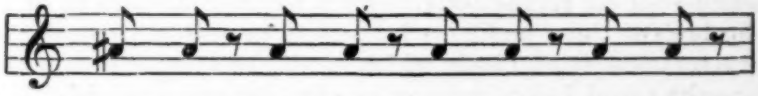
the music will instantly cease, to begin again as soon as all is quiet.

A few days ago I was told, by a lady residing here, that one night this summer, while rowing upon the river, she heard the music. "As we approached the sound," she said, "it seemed to go away from us, but we continued to follow it even some distance up the bayou on the other side of the river, when, for fear of losing ourselves in the intricate windings of the bayou, we left it."

My friend, the late Rev. R. G. Hinsdale, of Biloxi, has told me that at that place there are three different kinds of this music heard, viz.: the first is like that I have described; the second is a quick, sharp note sounded at different intervals, like this:



the third is another note repeated twice, as follows:



As I have before hinted, I have no theory of my own to offer in explanation of the strange phenomenon known as the mysterious music of Pascagoula, but shall merely give the theory that was advanced by Darwin years ago. In his "Descent of Man," page 347 (revised edition), Darwin says, "The last point which need be noticed is that fishes are known to make various noises, some of which are described as being musical. Dr. Dufossé, who has especially attended to this subject, says that the sounds are voluntarily produced in several ways by different fishes: by the friction of the pharyngeal bones; by the vibration of certain muscles attached to the swim-bladder, which serves as a resounding-board; and by the vibration of the intrinsic muscles of the swim-bladder. By this latter means the Trigla produces pure and long-drawn sounds which range over nearly an octave. But the most interesting case for us is that of two species of Ophidium, in which the males alone are provided with a sound-producing apparatus, consisting of small movable bones, with proper muscles, in connection with the swim-bladder. The drumming of the Umbrinas in the European seas is said to be audible from a depth of twenty fathoms, and the fishermen of Rochelle assert that 'the males alone make the noise during the spawning-time, and that it is possible, by imitating it, to take them without bait.'"

Whether or not these fishes inhabit or visit the waters of the

Pascagoula, I am unable to say; but if Darwin's views are correct, and I have no doubt that they are, then we have a very probable explanation of the mysterious music; if not, then we are as much in the dark as ever.*

THE INDWELLING SPIRITS OF MEN.

By Hon. Major A. B. ELLIS.

IN the spring of 1889 an officer of the United States Army, who was visiting Nassau, N. P., for the benefit of his health, lent me a pamphlet, a reprint of Dr. Washington Matthews's "The Prayer of a Navajo Shaman," which had originally been published in the "American Anthropologist" for April, 1888, and at page 19 of that pamphlet I read as follows:

"The suppliant is supposed, through the influence of witchcraft, exercised either in this world, or in the lower world when in spirit he was traveling there, to have lost his body, or parts thereof—not his visible body, nor yet his soul, his breath of life—for both of these he knows himself to be still in possession of, but a sort of spiritual body which he thinks constitutes a part of him—the astral body, perhaps, of our theosophic friends. This third element of man belongs not only to his living person, but to things which pertain to it, such as his ejected saliva, his fallen hair, the dust of his feet, etc."

What struck me in this passage was the curious analogy between the belief thus stated to be held by the Navajos and one which, in the course of my investigation of the religious systems of the negroes of West Africa, I had discovered to be held by the various tribes of the Gold and Slave Coasts; and it is with the object of calling the attention of American anthropologists to this third element in man that I venture to put forward this paper.

The Navajo believes that there are three entities in man: (1) The

* [Prof. G. Brown Goode, in his "American Fishes," mentions several species to which the name Drum has been given because of their ability to produce sounds. In his account of the Sea Drum he says: "Another historical incident is connected with *Pogonias*. The legend of Pascagoula and its mysterious music, deemed supernatural by the Indians, is still current. 'It may often be heard there on summer evenings,' says a recent writer. 'The listener being on the beach, or, yet more favorably, in a boat floating on the river, a low, plaintive sound is heard rising and falling like that of an Æolian harp, and seeming to issue from the water. The sounds, which are sweet and plaintive, but monotonous, cease as soon as there is any noise or disturbance of the water.' Bienville, the French explorer, heard the music of Pascagoula when he made his voyage in 1699 to the mouths of the Mississippi, and his experiences are recorded in his narrative." Speaking of the Lake Drum, Prof. Goode remarks: "These names, 'Croaker,' 'Drum,' 'Thunder-pumper,' etc., refer to the croaking or grunting noise made by this species in common with most Sciænoids. This noise is thought to be made in the air-bladder by forcing the air from one compartment to another."—Editor.]

corporeal man; (2) his soul, the vehicle of independent personal existence, which, at the death of the body, survives and continues its career in the land of spirits; (3) his spiritual body, which Dr. Matthews terms his "third element." The Tshi-speaking negroes of the Gold Coast—that is, the Ashantis, Fantis, Wassaws, Gamans, and several other tribes—believe similarly in three entities: (1) The corporeal man; (2) his soul, or ghost; (3) the indwelling spirit of the living man, which they term his *kra*.

Now, though the *kra* has frequently been confounded with the soul or ghost, it is essentially distinct. The soul or ghost only comes into being when the corporeal man ceases to exist, and so may be considered to be the latter deprived of his material body; but the *kra*, the Tshi-speaking negro believes, existed independently before the birth of the man, and after his death will continue to exist equally independently of the soul or ghost. A *kra* may have, and almost always has, been a *kra* in the bodies of other men since deceased, and, at the death of the individual whose body he is now tenanting, will seek to enter the body of some new-born human being. Failing this, it enters the body of an animal, and, if unable to enter the body either of a human being or of an animal, it becomes a *sisa*, a *kra* without a tenement, and wanders about the earth, causing sickness to mankind. The ghost or soul which, at the death of the corporeal man, proceeds to Dead-land, and there continues the former vocations of the man, and for whose service in Dead-land slaves and wives are sacrificed, and arms, implements, and clothing buried with the corpse, is the vehicle of individual personal existence, the true soul; and the *kra*, whose connection with the man commences with the birth and terminates at his death, is something quite different.

The difference between the *kra* and the soul is also well shown by the different results which ensue when they quit the body. The *kra* can and does quit the body at will. Usually it does so only during the sleep of the man, who is unconscious of its departure, and its adventures are the occurrences of which the man dreams. If it should leave while the man is awake, the latter is only made conscious of it, if at all, by a yawn, a sneeze, a shudder, or some such slight convulsion, which indicates to him that his *kra* is going out. In any case, whether sleeping or waking, he suffers no pain, feels no inconvenience, and is subject to no apparent change consequent on the departure of his *kra*. The absence of the *kra* is, however, dangerous, as it affords an opportunity for a *sisa*, or *kra* without a tenement, to enter the vacant body, for which the *insisa* are believed to be always on the lookout. The man is not conscious of the entry of the *sisa*, and nothing happens until the *kra* returns and attempts to eject the intruder, when the effect of the internal struggle is to throw the man into

convulsions. In this manner the West African negroes seek to account for epileptic and similar seizures; they are what used to be termed cases of "possession," but they are not directly attributable to the departure of the *kra, per se.*

When, however, the soul quits the body, the latter falls at once into a motionless and lifeless condition. Sometimes, though but rarely, the soul returns, and then the man has been in a swoon or trance; more frequently it does not return, and then the man is dead. It is in the hope that the soul may return that appeals to the dead to come back are always made, and that the corpse is kept until the signs of corruption show that the soul has gone forever. The difference, then, between the results of departure is clear. When the *kra* departs, there is no direct and immediate result, though the departure may lead to "possession"; but when the soul departs, the direct and immediate result is suspended animation or death.

The Ewi-speaking peoples of the Slave Coast—the Awunas, Krepis, Dahomis, Mahis, etc.—hold exactly similar views; the third element, or indwelling spirit of man, being by them termed a *luivo.* The Ga-speaking peoples of the eastern districts of the Gold Coast have modified the more original conception, and believe that each individual has two *kla* (the Ga-term for *kra*), a male and a female, the former being of a bad disposition and the latter of a good.

By all the tribes of these three lingual groups the indwelling spirit is believed to afford some protection to man. It receives occasional thank-offerings, and the anniversary of each individual's day of birth is held as a day sacred to the spiritual tenant. On this account the *kra* may be regarded in some respects as a guardian spirit, dwelling in the body of the man; but it is more than that. Its close connection with the man himself is indicated by the fact of its nocturnal adventures during its absence from the body being remembered by the man when he awakes. The latter even feels physically the effects of his *kra's* actions; and when the negro awakes from sleep feeling stiff and unrefreshed, or with limbs aching from muscular rheumatism, he invariably attributes these symptoms to the fact of his *kra* having been engaged in some struggle or some severe toil. If, moreover, a man dreams of other men, he believes that his *kra* has met theirs; consequently, the *kra* is held to have the outward appearance of the man whose body he tenants. Hence the *kra* is more than a mere tenanting or guardian spirit. He has, though doubtless only in a shadowy form, the very shape and appearance of the man; and both the mind and body of the latter are affected by and register the results of the *kra's* actions. How the notion of such an existence came into being it is beyond the province of this paper to inquire. It is

sufficient that it does exist, and that the *kra* is believed to be essentially distinct from the soul or ghost, which, at the death of the body, proceeds to Dead-land, and there continues the life that the man led in the world.

I am unaware if American anthropologists have considered this third element of man, and its bearing upon the theory of animism, or even if instances of the belief being held, other than that mentioned by Dr. Washington Matthews, have been recorded; but in Europe it seems quite to have escaped notice, and the belief is not referred to in any one of the text-books of anthropology that I have examined. This is doubtless in consequence of the German missionaries in West Africa having translated the words *kra*, *kla*, and *luivo* as "soul," a term which is not at all applicable, and which has led to the third element being confused with the soul proper.

It is in its bearing upon that branch of animism which is termed Nature-worship that this third element seems most important. The negroes of the Gold and Slave Coasts, like every other people low in the stage of civilization, believe that inanimate as well as animate objects have souls or ghosts—a belief which is proved by the practice of burying arms, implements, utensils, etc., for the use of the dead in Dead-land. The soul or ghost of the dead hunter goes to Dead-land, and there continues the former pursuit of the man, using the souls or ghosts of the weapons buried with him; but the negroes have gone beyond this, and, just as they believe man to possess a third element or indwelling spirit, so do they believe that every natural object, everything not made by human hands, has, in addition to its soul or ghost, a third element or spiritual individuality. They hold that just as, when the man dies, the *kra* of the man enters a new-born child, and the soul or ghost-man goes to Dead-land; so, when the tree dies, the *kra*, so to speak, of the tree enters a seedling, and the ghost-tree goes to join the ranks of the shadowy forest in Dead-land. And it is these animating or spiritual tenants of natural objects and natural features that the negro fears, and consequently worships.

The process is something like this: Some day a man falls into a river and is drowned. The body is recovered by the man's comrades, and is found to present no sign of external injury which, in their experience, would account for death. Being necessarily ignorant of the processes by which life is maintained, and seeking for a cause to which to attribute the disaster, they conceive the spiritual tenant or spiritual individuality of the river to have killed their comrade. And to this day, when a negro is drowned, his friends say, "So-and-so" (the spirit or god of the river) "has taken him down." Whether it was with the design of accounting

satisfactorily for such accidents—for to man in a low state of culture nothing happens by chance—that the negro extended to natural objects and features the theory of a third element which he had hitherto restricted to himself; or whether he had already formed the belief that such objects and features possessed spiritual individualities, and such accidents only proved to him the malignity and power for evil of those beings, the result would be the same. In either case he would seek to propitiate these powerful beings, and that class of worship which we term Nature-worship would originate.

The theory of animism is divided into two parts, namely: that which treats of the souls or ghosts of individual creatures or objects, capable of continued existence after the death or destruction of the material part; and that which treats of spiritual beings, or gods, who are held to affect and control man's life and the events of the material world. In explanation of the first belief we have the well-known theory advanced by Mr. Herbert Spencer, Dr. Tylor, and others, and which is now very generally accepted; but for the origin of the second belief we have no such satisfactory explanation, and have to fall back upon the theory that the *dei loci*—the gods of mountains, rivers, lakes, rocks, and trees—are deified dead men, an explanation that will only apply in a few isolated cases. Here, however, on the Gold and Slave Coasts of West Africa, we find ready to hand a belief which explains the origin of such beings. If a tree should fall in the forest and crush a man, those who witness the accident, or find the body crushed under the fallen tree, have no hesitation in immediately attributing the disaster to the indwelling spirit, or third element, of the tree. This is the belief held, and the explanation invariably given. Naturally, those indwelling spirits which time and experience show to be harmless, are not much regarded; the indwelling spirits of stones, bushes, etc., are considered of but little importance, and, though the belief in their existence remains, they are disregarded, and the worship and offerings are applied to propitiate those which are believed to possess both the power and the desire to injure. Hence we find, generally speaking, that the features worshiped are such as rivers, lakes, the sea, cliffs, mountains, etc.—that is, localities in which accidents are more liable to occur. The indwelling spirits or third elements of such features are not regarded as being inseparably bound up with them. Like the *kra* of the man, each ordinarily resides in its own feature or object, but can and does leave it temporarily. At a later stage, when priestcraft has intervened, the indwelling spirit is held to enter the image, made by the priests to represent it, while sacrifice is being offered, and also the priest himself, who then becomes inspired.

It is clear, from their construction, that the Tshi, Ga, and Ewi

languages all belong to one family, and that the tribes now speaking them are descended from one common stock. The question then arises, Is this an isolated belief which will account for the origin of Nature-worship in certain districts of West Africa, and must be limited to them; or is it a wide-spread belief which will account for the origin of that form of worship generally? Further researches can alone determine this satisfactorily, but there are certain indications which tend to show that the belief is wide-spread. It must be remembered that it is unusual for students of anthropology to come into direct contact with people in that condition which we term savagery, and ordinary travelers possessing, like all Europeans, the belief in one soul only, and perhaps never having conceived the possibility of a man supposing himself to possess a third element, would be very unlikely to make any inquiries in this direction. Even if a communicative native stated to him his theory of an indwelling spirit, or third element, the traveler would perhaps doubt if he really understood him; but people low in the stage of civilization are not communicative on such points. Consequently, we can not expect to find many indications, but there are some.

Cross tells us* that the Karens, who inhabit parts of Burmah, Tenasserim, and Siam, believe in two elements in addition to the corporeal man, viz., the *thah*, which seems to answer to the soul, and the *là* or *kelah*, which is described as a "life-phantom"; and Williams,† that the Fijians say that a man's "shadow" or "dark-spirit" goes to Dead-land, and that his "light-spirit" stays near where he dies. These appear to be beliefs somewhat analogous to that in the *kra*, but these different elements have not yet been defined. The *genius natalis* of the Romans, too, presents many points of resemblance to the *kra*. Like it, it entered the man at birth, and attended him till death. It was regarded as a second spiritual self, and the anniversary of the birthday of the man was held as a day sacred to it, libations being offered to the image by which it was represented among the household gods. At a later period of the Roman dominion this belief was modified, and, as among the Ga-speaking peoples of the Gold Coast, a belief in two indwelling spirits, one good and one bad, was formed. It was the latter which appeared to Brutus in the camp at Sardis. "What art thou?" said Brutus; "art thou god or man?" The apparition answered: "I am thy evil genius, Brutus. Thou wilt see me at Philippi."‡

It is, however, in America that we find the greater number of indications. Foremost stands Dr. Washington Matthews's above-mentioned account, in which the belief of the Navajo in the third

* "Journal of the American Oriental Society," vol. iv, p. 310.

† "Fiji," vol. i, p. 241. ‡ "Plutarch's Lives" (Marcus Brutus), p. 684.

element of man is directly stated; and in connection with this there is the following passage from the "Ethnography and Philology of the Hidatsa Indians,"* by the same learned author:

"They" (the Hidatsa Indians) "worship everything in nature. Not man alone, but the sun, the moon, the stars, all the lower animals, all trees and plants, rivers and lakes, many bowlders and other separated rocks, even some small hills and buttes which stand alone—in short, everything not made by human hands, which has an independent being, or can be individualized, possesses a spirit, or, more properly, a *shade*.

"To these shades some respect or consideration is due, but not equally to all. For instance, the shade of the cottonwood, the greatest tree of the upper Missouri Valley, is supposed to possess an intelligence which may, if properly approached, assist them in certain undertakings; but the shades of shrubs and grasses are of little importance. . . . Formerly it was considered wrong to cut down one of these great trees, and, when large logs were needed, only such as were found fallen were used; and to-day some of the more credulous old men declare that many of the misfortunes of the people are the result of their modern disregard for the rights of the living cottonwood."

These views are exactly similar to those held by the negroes of the Gold and Slave Coasts. With them, as with the Hidatsa Indians, the shades, or third elements, of shrubs and grasses, which experience has proved to be innocuous, are of little importance; while, like the cottonwood, the *Bombax*, the giant of the West African forest, whose gray trunk frequently rises to a height of ninety feet before a single branch is thrown out, is reverenced. The Tshi-speaking peoples have indeed classed the indwelling spirits, or third elements, of these trees into a species called *Srahmantin*—monstrous beings, gray in color and with long hair, who hurl down the decayed trees upon passers-by. How did the Hidatsa Indians form the belief that "everything not made by human hands, which has an independent being, or can be individualized, possesses a spirit, or, more properly, a shade"? Do they, like the Navajos, believe that they possess a third element; and have they, like the negroes of the Gold and Slave Coasts, extended the belief to all nature, or has with them Nature-worship originated in some other way?

Among other instances reported from North America the following may be mentioned: The Algonquins are said to believe in two "souls," one of which goes out during sleep, and whose adventures during its absence are the occurrences dreamed of, while the other stays with the body. The same people are also said to believe that sickness is caused by the man's "shadow"

* Washington, Government Printing-Office, 1877, p. 48.

being detached from the body.* The Salish Indians of Oregon regard the spirit as distinct from the vital principle, and capable of quitting the body for a short time without the patient being conscious of its absence†; while the Dakotas are said to believe in four "souls." The first belief seems to resemble the *kra* theory; but here, as in most other cases, the use of the word "soul" tends to confuse the subject.

When attention is called to the subject, many more instances will no doubt be forthcoming; but here, at all events, is something to work upon: and, having regard to the great strides which the science of anthropology is making in the United States, it will not be difficult for American anthropologists to determine whether a belief in the possession of a third element by man is common to many tribes of the northern continent, and, if so, whether the origin of Nature-worship among such tribes may be attributed to an extension of this belief to natural objects and features.

NORTHERN LIGHTS.

By WILHELM STOSZ.

THE inhabitants of northern Europe, who passed their days in the midst of vast forests, and whose fancy fashioned the forms of heroes and of gods from the mists that hung over their vales, naturally associated with the gods they worshiped the phenomena of northern lights, which to them were revealed in all their splendor. Thus, the Edda gives descriptions of flaming steeds speeding to Walhalla, and of valkyries dashing on through seething flames. Nations that as yet rest close to Nature's breast do not seek explanations of such phenomena; while those that have risen to a higher plane of culture are in possession of simple descriptions of these occurrences, and also of crude attempts at investigating Nature's wonders. Thus, in the old writings of the Chinese, whose realm was a flourishing one two thousand years before our time, there may be found many accounts of the occurrence of northern lights. They observed red vapors arise in the northern heavens, which spread evenly to both sides; sometimes the fiery sheen was encircled by a large white bow, and flaming rays pierced the vapors. Such descriptions can only refer to northern lights.

In the Greek and Latin classics we find more detailed descriptions of similar phenomena. Aristotle, Cicero, Seneca, Pliny, Lucan, Plutarch, Tacitus, and others describe the appearance of

* Tanner's "Narrative," p. 291. † "Primitive Culture," vol. i, p. 437.

auroras more or less completely. Some authors, instead of giving a simple narration of events, seek for an explanation of what they observed. Of course, these attempts in the main are very *naïve* and without any scientific value.

Aristotle speaks of red beams in the heavens, of torches and of billows of fire. Seneca compares the phenomena to flashes of lightning, and writes about the blazing of the heavens. According to him, "the gleaming flashes may be caused by violent winds, or by the heat of the upper regions of the air; for, when the fiery phenomenon spreads far, it sometimes extends to the lower region, if it be inflammable."

Pliny writes: "Fiery beams occur likewise; such a one was seen when the Lacedæmonians, vanquished at sea, lost their sway over Greece. Sometimes the heavens cleave; this is spoken of as a 'chasma.' But naught is more terrible for mortals than when a blood-red conflagration starts in the heavens, and from there falls to the earth. This happened in the third year of the one hundred and seventh Olympiad, when King Philip warred in Greece. I, however, believe that these phenomena, as all others, occur at times regulated by Nature, and are not, as most people suppose, to be ascribed to a variety of causes which their fancies invent. They have, however, been premonitors of great misfortune. As they occur so very rarely, the law which they obey remains hidden, and may not be traced." Furthermore, "During the reign of the consuls Caius Cæcilius and Cneius Papirius, and also at other times, light was seen in the heavens, so that night became as day." The words of Lucan, "Fire storming from the north," remind us of the sagas of northern tribes.

The middle ages could not readily free themselves from the influence of the mysterious. Wondrous phenomena, the true nature of which was not grasped and understood, were veiled in mystery, and ascribed to the workings of demons. This is proved by many records and traditions. Does not Shakespeare possibly refer to northern lights in "King Henry VI," Part III, act ii, scene 1?—

> RICH. See, how the morning opes her golden gates,
> And takes her farewell of the glorious sun!
> How well resembles it the prime of youth,
> Trimm'd like a younker, prancing to his love!
> EDW. Dazzle mine eyes, or do I see three suns?
> RICH. Three glorious suns, each one a perfect sun;
> Not separated with the racking clouds,
> But sever'd in a pale clear-shining sky.
> See, see! they join, embrace, and seem to kiss,
> As if they vow'd some league inviolable:
> Now are they but one lamp, one light, one sun.
> In this the heaven figures some event.

Many investigators consider the observations of Gassendi, which relate chiefly to the phenomena of 1621, as the starting-point toward a more correct conception of the nature of northern lights. The first move toward a truly scientific investigation into the matter was made by Halley, who in 1716 suggested that auroras were a magnetic exudation from the northern pole of the globe. His contemporaries did not share Halley's opinion. Wolf, in Halle, maintained that the lights consisted of inflammable sulphurous fumes. Descartes and Triewald saw in them only a reflection of the snow and ice at the north pole. Mairan (1733) considered them formed by a blending of zodiacal light with the earth's atmosphere. The famous mathematician Euler adhered to a sort of nebular hypothesis and declared the aurora to be a phenomenon similar to that presented by the tails of comets. Halley had arrived at his view through the observation that the center line of the light-arc deviated to the west of the meridian to about the same extent as the north pole of a magnetic needle. This important discovery was followed by one made by Mairan, that the crown of the northern lights lies in the (prolonged) direction of the dipping-needle; and soon after this Hjoter, in Upsala, demonstrated the influence of the aurora on a magnetic needle placed horizontally (1741).

It was by these discoveries that the relation between northern lights and magnetism was established. Winkler (1746) and Van Marum (1777) compared the former to the electric glow which can be produced in rarefied air. The veil of the mystery had been raised, but only to disclose a new query, for the demonstration of the cause of these relations was a problem the solution of which was reserved for modern science. How far the efforts in this direction have been crowned by success we are now to consider.

Auroras are most frequently seen in the cold and in the northern temperate zone, rarely in the southern temperate zone, and hardly ever in the tropics. The places where they most frequently appear lie between the sixtieth and seventieth degrees of north latitude. In the form of an oval, they include the geographical as well as the magnetic north pole, which is to be found on the peninsula Boothia Felix, Iceland, the Kara Sea, northern Siberia, Bering Strait, Hudson Bay, Labrador, and Greenland. Northern lights have been seen as far down as the twenty-fifth degree of north latitude. In full splendor, however, they may be seen only in the northern polar regions to the seventy-fifth degree of latitude. Here Nature is displayed in all her grandeur. When the sun has set, and the gray veil of twilight is cast over the earth, the northern horizon grows darker and darker. Soon there may be distinguished a segment of the sky more somber than its background; this is hemmed in by white concentric arcs of light.

Colored rays shoot forth therefrom in all directions. They interlace and intertwine until they seem to be woven into one fluttering band of color. And anon it changes to a sea of fire! The rays leap upward far above the zenith, form there a flaming crown, and then sink back, to begin anew the wondrous play. The most beautiful descriptions and trustworthy observations we owe to Nordenskjöld and Ekama. All explanations which have been attempted as to the origin and the cause of northern lights are based on analysis by the spectroscope, on the determination of the elevation, and on observations of the peculiar behavior of the magnetic needle.

If northern lights are observed through a spectroscope, a characteristic yellowish-green line will always be seen, no matter how faint the light may be. If the phenomena are well pronounced, several red lines appear in the spectrum. What inferences may be drawn from these observations?

If a very powerful electric current is sent through what is called a Geissler tube filled with dried and rarefied air, sparks will flash from one platinum wire to the other, and if these are examined by the spectroscope they show the characteristic yellowish-green line. In a tube filled with nitrogen these lines are especially well pronounced. As nitrogen is the predominant constituent of the air, we infer the northern lights to be a phenomenon similar to the glowing of the electric spark in dry and rarefied air, in which oxygen and nitrogen are the sole conductors of electricity. If white sunlight is caused to shine on a solution of chlorophyl (the green coloring matter of leaves), it shows a blood-red color. This phenomenon, when the reflected light appears of a different color from that which is transmitted, is termed fluorescence. Electric light possesses to a marked degree the property of calling forth fluorescence, as can easily be demonstrated by various experiments. It may hence be assumed that the red lines in the spectrum of northern lights are due to the fluorescence of oxygen in the upper layers of air, caused by powerful electric discharges.

The determination of the elevation of northern lights serves to confirm the foregoing conclusions, for it is a well-known fact that in the higher regions of the atmosphere the air is dry and rarefied. The height of the auroral crown has been found to be five hundred kilometres, the lower boundary being about seventy kilometres.

Of greater importance for ascertaining the true nature of northern lights has been the demonstration of the relation these phenomena hold to terrestrial magnetism, a mysterious power of which our globe is the conductor. Powerful magnetic currents appear suddenly and disappear as quickly, and we are not able to name the cause of their existence.

Like a vast ocean the magnetic force is constantly surging

through our globe, here appearing, there receding, but forever seeking to attain its equilibrium. The instrument by which these occurrences are observed is the most simple conceivable — the magnetic needle. It is known that the direction and the inclination of the needle point out the magnetic location of a place. From its movement the degree of magnetic attraction of any point may be accurately determined. If sudden deviations and fluctuations of the needle occur, this evidently is an indication that the magnetic condition of the earth has been disturbed. If such variations always occur simultaneously with the appearance of northern lights, this is to be regarded as proof that an intimate relation exists between these phenomena and terrestrial magnetism. Strong northern lights, in fact, exert so great an influence on the magnetic condition of the earth, that the appearance of the phenomenon in some northern latitude may be inferred from the sudden oscillations of the needle in places where the lights are not visible. But the most striking connection between terrestrial magnetism and northern lights is shown by the position of the light-crown in the heavens. The center of this is always to be found at that point where the dipping-needle, if prolonged, would meet the aurora. The rays emanating from the arc have the direction of the earth's magnetic power; they are therefore parallel, and only apparently converge to a point. The crown of light has in truth no fixed place in the heavens, but like the rainbow its position depends on the point from which it is observed, and thus moves with the observer. But the dipping-needle in every place points to the center of the crown.

It may hence be asserted that the northern lights hold an intimate relation to the changes of terrestrial magnetism as indicated by the oscillation of the needle, and that both phenomena must have one and the same cause. The explanation of this cause has been sought in various ways, but an interpretation which would be universally accepted has thus far not been advanced. One of the first attempts to solve the problem was made by the physicist De la Rive, of Geneva, in 1862. It was based on an experiment devised by him, in which he attempted an imitation of these phenomena on a small scale. He held that vapors charged with positive electricity rise into the higher regions of the atmosphere, while the earth remains charged with the negative fluid. When the vapors are driven by the trade-winds to the poles, as soon as the tension is sufficient to overcome the non-conducting property of the air, which like an insulator lies between the earth and these vapors, the positive and the negative electricity come together. This process is accompanied by the appearance of light. The earth and the upper layer of the atmosphere must hence be regarded as an electrical condenser, with the lower layers

of air as the separating medium. An actual proof that the northern lights are caused by electric currents in the atmosphere was attempted by Lemström in 1883. He covered the plateaus of two mountains in northern Finland with a network of copper wires raised several metres above the ground and provided it with hundreds of metal points. The whole was insulated and connected with a zinc plate buried in damp ground in the plain below. A continuous electric current from the air to the ground was noticeable, and a light which appeared hovering over the metal points showed, when examined by the spectroscope, the characteristic line of the auroral spectrum.

The theories, however, according to which the northern lights are a flowing together of terrestrial and atmospheric electricity of opposite kinds, leave unanswered the question as to the origin of these electric fluids. As no adequate cause could be found on the globe for such a tremendous evolution of electricity, attention was directed to the sun as the source of it all. Why should not Helios, the giver of all light and life of our world, be as well the creator of that inexhaustible force of nature that is revealed in the splendors of the northern lights?

As the endless supply of light and heat which is radiated into space by the sun, is accounted for by the contraction of that body, this may also be assigned as the cause of the stupendous generation of electricity. According to the theory of Kant and Laplace, the sun and other heavenly bodies are assumed to have been formed by the condensation of vapors which originally filled all space. This condensation is still going on in the sun in consequence of the enormous radiation of heat into space, and with it the consequent contraction.

Possibly also there might be suggested as a cause the cooling process which the sun is undergoing. It may be assumed, too, that vast amounts of electricity are hurled into space with the ignited masses of gas, whose eruption from the sun may be constantly observed. But it is more probable that the sun acts upon the earth by induction. Try the following experiment: Two insulated spheres are placed near one another, but without being in contact. On one of these spheres a bar of metal is placed, to which there is fastened a screen made of some good conducting material. If one of the spheres is charged with a certain kind of electricity, say, for instance, negative electricity, the opposite kind—in this case positive electricity—will, by induction, be generated on the other sphere. A corresponding amount of negative electricity will in the mean time be discharged on to the screen. An action similar to this may be assumed to be going on between the sun and the earth.

The sun's electricity, which may be assumed to be negative on

account of the preponderance of metal in the composition of that body, generates positive electricity on the earth by induction, while the negative electricity passes over into the atmosphere surrounding the earth. The constitution of the air at different times and at different places favors this process more or less. The conducting metallic rod of our electrical experiments may be considered here as being replaced by mountain-peaks projecting high into the air.

If the equatorial currents, already mentioned by De la Rive, are borne in mind, it is evident that the air at the poles must be highly electrified, and that an exchange must then and there take place between the negative electricity and the positive (induced) electricity. This exchange gives rise to phenomena of light identical with those observed as northern lights at the north pole and as southern lights at the south pole.

This theory is strengthened by the observation that northern lights are closely connected with the appearance of sun-spots and protuberances on the sun. Already in former times a certain periodicity of northern lights was noticed. Besides the annual period in which they appear most frequently at the times of the equinox, and least frequently at the times of the solstices, a period of eleven years has been observed, corresponding closely to that of the sun-spots, the maximum of which coincides with the maximum of northern lights.

The appearance of sun-spots and protuberances, the connection between which was pointed out by Tacchini in 1885, may be regarded as signs of changes occurring on the sun, probably involving increased combustion.

This increased activity must influence the induced terrestrial electricity, and in consequence also the phenomena of northern lights. The variations and declinations of the magnetic needle, moreover, give indubitable proof of the connection between the periods of sun-spots and the electrical condition of the earth.

It should not seem strange that the terms electric and magnetic condition have been here used as synonymous. Since Oersted's discovery of the influence of the electric current on the magnetic needle, and Ampère's theory of magnetism, electricity and magnetism are regarded as merely two different forms of one and the same force of nature.—*Translated for the Popular Science Monthly from Ueber Land und Meer.*

PROF. FLOWER expressed the opinion, in his presidential address before the British Association, that an impartial survey of the recent progress of paleontological discovery must lead to the conclusion that the evidence in favor of the doctrine of a gradual transformation of living forms is steadily increasing.

DRAGONS, FABLED AND REAL.

By M. MAURICE MAINDRON.

THE geological age of reptiles was marked by various curious, seemingly only partly perfected forms, which appear to have passed away without leaving any permanent descent. To it belong the relics of those flying reptiles, the *Rhamphorhynchus* and the *Pterodactyls*. The type of the pterodactylean wing was not at all like that of the wings of birds, which were yet to come, and were beginning to appear when the reptilian era approached its close. The apparatus for flying was not formed by any essential modification of the limbs, but rather, like that of the bats, was constituted by a broad fold of the skin, attached to and sustained by the digits of the fore-limb. The last or outer digit, greatly elongated, formed a rigid side bordering and sustaining the parachute, which was further attached along the full length of the arm, and in the *Rhamphorhynchus* was continued to the tail. These animals also had a long tail ending in a membrane, sustained by rigid ribs, that served as a kind of rudder.

There were giants and dwarfs among the pterosaurians. Of the former were the *Pteranodus*, of the Kansas Cretaceous; and of the latter, little Jurassic pterodactyls, which were not larger than a lark.

The hieratic traditions of dragons appear at first sight to have been inspired by the singular forms of these monsters; and it would be easy enough to suppose that the simple-minded figure-makers of the middle ages were acquainted with the pterosaurians, and patterned after them in sculpturing the dragons and griffins which they set up at church entrances. But they did not. Man's imagination is always capable of associating different forms into individuals, and even of inventing new forms. That the dragons of art were such inventions is proved by the awkward attachments which the artists affixed to their strange conceptions. Some of their creatures, if living, would have had a hard task to fly with the wings they gave them; and others would have been greatly embarrassed to make use of all the appendages with which a hand more lavish than wise had endowed them.

Movement by flying, the realization of which is still only a dream for man, has had a charm for the mystics of all ages. All religions concur in the common fancy of putting wings on the shoulders of their gods, genii, cherubim, angels, and seraphim. There were necessary for the transportation of such forms, for company and service, and to do battle for them, animals having forms likewise supernatural and agile; whence hippogriffs,

chimæras, and dragons. St. Michael the archangel, with the wings of a bird, lies low and slays the fallen angel Lucifer, having bats' wings. Dragons have also had their contests with saints. St. George defeated a monstrous dragon; other holy personages followed his example, and the times became very hard for *gargoyles, tarasques,* and *guivres.* Many of the dragons were

FIG. 1.—WINGED DRAGONS. (From a MS. of the Fourteenth Century. Book of the "Wonders of the World.")

slain, and an old monkish chronicle tells how the skin of one of them was hung from an arch in a church. The historians and wise men of antiquity did not forget to describe these monsters. Pliny speaks of a precious stone, called *dracontias,* which could only be found in the head of a dragon. St. Augustine informs us that "the dragon often rests in his den; but whenever he feels the moisture of the air he is able to rise on his wings and fly with great impetuosity." Other authors exhibit dragons ejecting fire and smoke from their burning throats, and enveloping in flames the audacious enemy who ventures to attack them. Such fables found credence as late as the sixteenth century. Even the grave Gessner believed in the existence of these creatures, and has said: "Numerous dragons are found in Ethiopia, a fact to be attributed to the heat that prevails in that country. They are also to be found in India and Libya, where they reach a length of fifteen feet, and the thickness of the trunk of a tree; but they are generally larger in India than in any other country. Two kinds of dragons are known: those that live in the mountainous country are large, alert, and swift, and have a crest, while those that live in marshy regions are sluggish and idle. The former have wings, and the latter have not; some have feet, and can get rapidly over the ground. Their vision is sharp, their hearing delicate. They rarely sleep, and for that reason the poets have made them guardians of treasures that man can not get. Near their abodes the air is noisome with their breath, and rings with their hissings."

FIG. 2.—FLYING DRAGONS OF MALAYSIA, *Draco volans* and *fimbriatus*. (From specimens brought home by M. Maurice Maindron.)

These wonders, like other things of the kind, have had their day. The only dragons with which science now concerns itself are the little saurians, which are classed by some naturalists with

the acrodont iguanans and by others with the agamians, and of some of which we give representations.

There live in the forests of India, the Malay Archipelago, and the Philippine Islands, lizards, whose speckled dress and odd forms have long made them objects of interest to collectors. They live exclusively on insects, which they hunt with extreme agility of pursuit along the trunks and among the branches of trees. In whatever spot they may be hiding, their variegated liveries of gray and brown, speckled with black, yellow, or green, mask them effectively and cause them to pass unperceived in the cracks or among the inequalities of the bark. Squatting under this cover, they await the coming of some insect within reach of them; or they may be seen running rapidly and suddenly covering considerable space, by a kind of flight, to place themselves upon another tree or fix themselves near a vine. Nature has been, in fact, pleased to facilitate the movements of these lively and graceful beings by an ingenious artifice. By the aid of their parachute, dragons can execute leaps in the air of considerable length, and pass from one tree to another as if by flying. But it must not be supposed that they can fly after the manner of birds. They can descend rapidly, describing a large parabola, sometimes almost a horizontal, but can not fly upward.

I have frequently observed these pretty little saurians in Java. The first time I saw one I succeeded in shooting him with a small-bored gun loaded with fine shot. When I picked my victim up I was somewhat surprised to find that I had a dragon; for its jerky and irregular flight along a large tree had caused me to suppose that it was some kind of a grasshopper or moth, which I could not get in any other way than by shooting.

The dragons, as Cuvier says, fly by means of their ribs. Their first six pairs of false ribs, instead of being attached to the sternum, are drawn out and prolonged, so as to constitute the framework of a kind of umbrella, the covering of which is formed of a wide membrane making a fold in the skin of the flanks. This membrane is independent of the limbs. When at rest, it is folded up along each flank; but it can be quickly unfolded and spread out in case of need. The name *patagium* has been given to it. The head and neck are ornamented with crests and dewlaps, often variegated with brilliantly defined colors; and a long tail gives them a singular gait which is not without grace.

The harmless little flying lizards inhabit forests and garden trees; and nothing is more amusing than to watch their manœuvres, when, not aware that they are observed, they execute their gambols in the full flush of freedom. Running swiftly along the trees, stopping instantaneously, snapping up an insect or retiring

disappointed after they have missed it; pursuing one another; inflating their dewlaps and depressing their crests when enraged, they fly away spasmodically to drop a few yards farther along, down upon another tree, along which they continue their evolutions. In some dragons the tympanum is visible, in others it is hidden by a fold of the skin. A special genus (*Dranunculus*) has been constituted for the latter, while the former compose the genus *Draco*. This genus is represented by six species, of which three inhabit the island of Java; one, recognizable by its vertical nostrils, is peculiar to continental India; the fifth is native to the island of Timor; and the sixth is found at Pulu Penang. The *Dranunculus* inhabits Amboyna in the Moluccas, Celebes, and the Philippine Islands.

The dragons are the only existing reptiles that possess organs of aerial locomotion. Other saurians have folds of skin along the flanks; but in no other of them is this disposition so developed as in a curious geckotian, the *Ptychozoon homacephalum* of Java and other Sunda Islands. A broad membrane extending from the temples to the tail, where it is divided into slit lobes, is broadened along the flanks. Without reaching the dimensions of the *patagium* of the dragons, or possessing its rigid supports, it represents a kind of parachute, the importance of which may have been augmented by long use; or else we may regard these extensions of the skin as survivals of a provision which sedentary or profoundly changed habits have rendered useless.

It may be added that the livery of the *Ptychozoon* is of such a nature as to assure it all the advantages of protective resemblance. The green color, yellowish on the upper side of the body, greenish along the flanks, varied with brown lines or transverse brown fasciæ, constitutes a general tone which becomes, with wonderful ease, confounded with the bark and parasitic plants with which the trees are covered where they pass their lives.—*Translated for the Popular Science Monthly from La Nature.*

[To this account of these interesting animals we add a portrait of the frilled lizard (*Chlamydosaurus Kingii*), which possesses an appendage of different structure from the wings of the dragons, but at the first view reminding one of them. The frill, which is its conspicuous ornament, is covered with scales and is toothed on the edge. It does not come of full size till the animal is grown, and increases—according to Wood—in regular proportion to the age of the owner. In the young it does not even reach the base of the fore-limbs, while in the adult it extends well beyond them. M. F. Mocquard, who observed one of the animals during several weeks, is of the opinion that it serves the lizard as a kind of parachute, sustaining it during its

FIG. 3.—THE CHLAMYDOSAURUS. (From a specimen in the Reptile Menagerie in the Museum of Natural History in Paris.)

leaps. It is essentially a tree-inhabiting animal, though it can run very swiftly along the ground. According to Captain Grey, who observed it in nature, "when not provoked or disturbed it moves quietly about, with its frill lying back in plaits upon the

body; but it is very irascible, and directly it is frightened it elevates the frill or ruff and makes for a tree, where, if overtaken, it throws itself upon its stern, raising its head and chest as high as it can upon the fore-legs, then, doubling its tail underneath the body, and displaying a very formidable set of teeth from the concavity of its large frill, it boldly faces an opponent, biting furiously whatever is presented to it, and even venturing so far in its rage as to fairly make a charge at its enemy." M. Mocquard says it is quite inoffensive. It is nearly three feet in length, including its very long tail, is of a tawny color, with mottles on the back and blackish rings on the tail. The teeth on its fringe have white ends, and at a distance look like pearls. It belongs to the family of the agamians, and is represented only by a single species, in Australia.—EDITOR.]

ALCHEMIST'S GOLD.

BY M. A. DE ROCHAS.

"THE definite and unchangeable existence of sixty-six distinct elements, as we regard them now, would assuredly never have occurred to an ancient philosopher, or rather would have been dismissed by him as ridiculous: it had to be imposed upon us by the incontestable force of the experimental method. Is this, then, the final limit of our conceptions and hopes? Not at all; for really this limit has never been accepted by chemists except as a present fact, which they have always hoped to pass by."

This paragraph, quoted from Berthelot's "Origins of Chemistry," explains why so many distinguished men have spent their days in seeking the transmutation of metals. Did they find it? Excellent minds assure us that they did not, because, in spite of the infinitely more powerful forces we now have at our disposal, we have not been able to decompose any metal. Others maintain that the reasoning is not conclusive; for numerous industrial processes have been lost, and we knew how to convert alcohol into vinegar long before we could analyze either substance; and there is one element—time—which the moderns, with their intensive life, can not use as their predecessors did. Where is the man now who would bind himself down for years to make the projecting powder or the philosopher's stone—representing the hypothetical ferment of inorganic substances—or who could count enough upon the future to bequeath the continuation of his experiments to his heirs, as did the adepts of old?

There have been many alchemists who, notwithstanding the satirical definition of their art—"*Ars sine arte; cujus principium mentiri, medium laborare et finis mendicare*" ("An art without

art; the beginning of which is to lie, the middle to work, and the end to beg")—have acquired considerable wealth, the source of which it is hard to divine in any other way. M. Louis Figuier has collated the stories of the principal of them in his "History of Alchemy." I purpose in this article to describe some medals which were struck from gold which was said to have been compounded. I have seen one of the pieces, and tried to buy it for purposes of analysis, but the holder would not sell it. Probably an interesting collection might be made of such medals.

In 1312 Raymond Lulle went to the British Islands in an effort to induce Kings Edward III and Robert Bruce to engage in a crusade, and promised to pay all the expenses of the expedition by means of his art. King Edward, more concerned about making gold than about going to the Holy Land, furnished the alchemist with a laboratory in the Tower of London; and there Raymond, according to a declaration in his will, at a single operation converted fifty pounds of mercury, lead, and tin into "gold." This "gold" was used in striking "rare nobles," some of which weighed as much as ten ducats, and must, therefore, have been as large as a French hundred-franc piece. Under the name of Raymond's nobles, they have been much sought for by English collectors.

King Henry VI granted to several alchemists the right of making gold and silver out of the base metals. The products of their industry were probably used for coining the false money, the emission of which provoked prohibitory measures from the Scotch Parliament. Conrad Barchusen, a Dutch chemist of the beginning of the eighteenth century, assumed that the "gold" of Henry VI was obtained by putting mercury and sulphate of copper in an iron crucible with a little water. The copper, set free by the action of the iron, formed with the mercury an amalgam which, washed and pressed to drive out the soluble substances and the excess of mercury, gave on fusion a metal having the color of gold, but lighter, and readily taking the impress of the die.

At about the same time, Barbe de Cilley—wife of the Emperor Sigismund of Germany—pretended that she had found the philosopher's stone, in order to make her subjects accept an alloy of copper and arsenic for silver, and an alloy of gold, copper, and silver for gold. The alchemist Jean de Laaz solicited from her the privilege of being present at one of her transmutations. He detected the cheat, and was simple enough to reproach her Majesty for having bungled; and for this he barely escaped going to prison.

Jacques Cœur obtained from Charles VI of France, in consideration of his possession of the secret, power to coin money of

"silver," some of the pieces of which were described by De Planis Campy as still existing in 1633. They bore his name and the three hearts of his arms.

Monconis* tells of a merchant of Lubeck who transformed lead into a hundred "gold" livres in the presence of Gustavus Adolphus, King of Sweden; and who furnished the gold from which ducats were coined, bearing on one side the figure of the prince, and on the other side his arms, associated with alchemic symbols, in recollection of the origin of the metal. The merchant died some years afterward, leaving an enormous fortune, although his trade had been insignificant.

Christian IV of Denmark, in 1646, appointed as "alchemist to the king" Gaspar Harbach, who made him some "gold," from which were coined medals bearing the inscription "*Vide mira Domini* ('Behold the wonders of the Lord'), 1647," beneath the sign O—O, designating mercury.

An Austrian named Richtausen, in 1648, received as a bequest from one of his friends a casket containing precipitating powder; with a grain of this powder, the Count de Rütz, director of the mines of the empire at Prague, in the presence of the Emperor Ferdinand III and the absence of Richtausen, transformed three livres or six marks of mercury into five marks of "gold." Rodolph had struck in this "gold" a medal which still existed in the Treasury at Vienna in 1797. It represents the god of the sun carrying the caduceus and having wings on his feet—all by way of reminder of the formation of "gold" by the aid of mercury.† In 1650 the emperor made a second precipitation at Prague, from lead; and the medal struck on this occasion bore the inscription "*Aurea progenies plumbo prognata parente*" ("Golden progeny of a lead parent"). This medal was still shown in the last century, in the collection of the Château d'Ambras (Tyrol). Richtausen received for his discovery the characteristic title of Baron of Chaos.

General Paykhul, in 1706, made for King Charles XII of Sweden, with lead and a few grains of his powder, under the surveillance of artillery-general Hamilton and the chemist Hieme, a mass of "gold" sufficient for the coinage of one hundred and forty-seven ducats; a commemorative medal, struck on the occasion, from the same "gold," weighed two ducats and bore the inscription "*Hoc aurum arte chimica conflavit Holmiæ* 1706, *O. A. V. Paikhull*" ("This gold O. A. V. Paikhull produced by chemical art at Holm in 1706").

* "Voyage d'Allemagne."

† Arsenic (το ἀρσενικόν, the male) was one of the first substances tried for the purpose of transmutation. Its vapors whitened copper (which was considered a female element, was dedicated to Venus, and was represented by the sign ♀), forming an arseniuret; and this change was for a long time regarded as the beginning of transmutation.

In 1704 a goldsmith of Lubeck, named Stolle, received a visit from a stranger, supposed to be the celebrated adept Lascaris, who, after a discussion respecting the transmutation of metals, left with him, as a proof of the possibility of the operation, an ingot weighing about a half-livre, which he said he had just made; he asked Stolle to treat it with antimony to purify it, heat it, and cut it into seven pieces. He then left two of the pieces with the goldsmith as a souvenir, and added eight ducats. One of the pieces was given to King Augustus of Poland, and the other was deposited in the collection of medals at Lubeck. They bore the inscription "*O tu . . . philosophorum*" ("O thou . . . of philosophers!"), which the adept had had engraved by the goldsmith.

A Provençal locksmith, named Jean Troins, who called himself the Sieur Delisle,* fabricated in the presence of M. de Saint-Maurice, president of the mint at Lyons, and at the Château Saint-Auban, two ingots of "gold," one from mercury and the other from lead. On trying to strike medals from this preparation at Lyons, the minter found it "so hard that it was not possible to work it." It was then sent to Paris, to the controller-general of finance, who had a number of medals struck from it bearing the inscription "*Aurum ex arte factum*" ("Gold made by art"). One of the medals was deposited in the Royal Cabinet, and, according to Langlet-Dufresnoy, its allotted square was still existing at the mint in 1762. I have handled and have an impression of a piece which, although the inscription is not identical with that described by Dufresnoy, was most probably made from Delisle's metal.† Its density is perceptibly different from that of gold, and that should give it a place in the class of tokens without value. Some spots of verdigris disappeared under the action of nitric acid, which did not attack the rest of the metal. Delisle likewise made, under similar circumstances, but with a different powder, an ingot of "silver," from which two crowns, two half-crowns, two quarters, and three ten-sous pieces were struck.

In 1717 Landgrave Ernest Louis of Hesse-Darmstadt, who

* Delisle is accused of having been the servant of Lascaris, and of having assassinated him in Savoy, in order to steal his powder. After this crime, in 1706, he established himself at Sisteron, where he married and soon achieved a great local notoriety by changing nails, knives, shoe-buckles, rings, etc., of iron and steel into "gold" or "silver." Some of these transformed objects might, perhaps, still be found in the country if one should be at the pains of searching for them. Delisle resided in succession at Sisteron, the château of Palud Digne, where he is said to have enriched a merchant named Taxis; at Castellane, and at Senéz, where he performed several times before the bishop.

† Possibly, however, this was a mock token, like those which were struck in England in 1815, when Napoleon was sent to St. Helena. That token was just like a twenty-franc piece, and bore the figure of the emperor on one side and a ship on the other, with the inscription "This is copper."

was an amateur alchemist, received by mail a little box containing two packages of powder, one red and the other white, with directions for using them. He was thus able to enjoy the pleasure of himself changing lead into "gold" and "silver." From the "gold" he struck a few hundred ducats, bearing on one side his name and effigy, and on the other the lion of Hesse and his initials, E. L. From the "silver" he struck a hundred thalers bearing his name and likeness on one side, and on the other the inscription "*Sic placuit Deo in tribulationibus*" ("Thus it has pleased God in tribulations"), 1717, with the lion of Hesse and his initials, surrounded by four crowns.

These operations made so much stir that the Academy of Sciences was moved by it; and in 1722 the chemist Geoffroy was charged to demonstrate to the learned company that these extraordinary achievements were a pure fraud. In the report, which he read on the 15th of April, he said: "Since the main intention of the operators is usually to show gold or silver in the place of the minerals which they pretend to transmute, they sometimes use double crucibles or cupels, or they put salts of gold or silver in the bottom of them; they then cover the bottom with a paste made by mixing crucible-dust with gum-water or wax; doing it so that this false bottom shall seem to be the real bottom. At other times they put gold or silver dust in a hole made in a piece of charcoal; or they saturate charcoal with solutions of those metals and then reduce the mass to a powder, in order to project it upon the substances which they are going to transmute.

"They use rods with hollowed ends containing in the cavities gold or silver filings, and stopped up with sawdust of the same wood. Stirring their molten matter with these rods, the sticks burn, leaving in the crucible the metal with which they have been charged. In an endless variety of ways they mix gold or silver with the substances with which they work. A small quantity of gold or silver will not show in a large quantity of such metallic substances as the regulus of antimony, lead, or copper. Salts of gold and silver can very easily be mixed with salts of lead, antimony, and mercury. Grains or nuggets of gold and silver can be inclosed in lead. Gold may be whitened with quicksilver and made to pass for tin. The collection of gold and silver from the substances with which they have been mixed may be made to pass for transmutation.

"All that goes on in the hands of these people should be watched. For the *aqua fortis* or *aqua regia* which they use is often already charged with solutions of gold or silver. The papers in which they wrap their chemicals are sometimes loaded with salts of these metals; and the pasteboards they employ may conceal such salts in their thickness. Glass has been known to come out

from furnaces charged with portions of gold which had been admittedly slipped in while it was molten.

"Some alchemists have imposed on their spectators with nails half of iron and half of gold or silver. They make believe that they effect a real transmutation of half of these nails by dipping it into a pretended tincture. Nothing is more seductive at first; but it is, after all, only a trick. The nails, which seemed to be all iron, were really in two pieces neatly soldered, the gold or silver to the iron, and washed with an iron-colored wash, that disappeared when they were dipped into a suitable liquid. Of this character was the gold and iron nail formerly to be seen in the cabinet of the Grand Duke of Tuscany; of like nature are those half-silver and half-iron nails which I present to this society today. Such also was the knife which a monk once presented to Queen Elizabeth of England, in the earlier years of her reign, the end of the blade of which was of gold; as well also those knives, half silver and half iron, which a famous quack scattered a few years ago over Provence. It is true that they say that this last performer operated on knives that were given him, and which he gave back after a time with the ends of the blades silvered. But there is reason for supposing that the change was made by cutting off the end of the blade and soldering on a similar end of silver.

"There have been also pieces of money and medals half gold and half silver. Such pieces were said to have been originally all silver, half of which was turned into gold by dipping them half-way into the philosopher's mixture, without the outer form or the engraved designs being essentially changed. I say that no such medal was ever all silver, but that they were in two pieces, one of silver the other of gold, so soldered together as to preserve the proper arrangement of the characters. The thing could be easily done by having several silver medals of the same kind, a little worn, and making molds of them in sand for casting copies in gold. The sand would not even have to be very fine. Then let the medals be cut exactly to rule, fitted by filing, and the complementary halves soldered together with care, to have the designs precisely correspond. Any trifling flaw could be mended with the graver. The part of the medal that is of gold, having been cast in sand, looks a little grainy and is rougher than the silver part, which was pressed; but this fault was given out to be an effect or a proof of the transmutation; because a given quantity of silver, having a larger volume than a like quantity of gold, the silver shrunk some in changing into gold, leaving the pores or spaces that constituted the grain. The operator, besides, took pains to make the golden part a little thinner than the silver, to keep up the semblance; and to use only as much or not quite as much

gold as there was of silver. A second medal was prepared in the same way.

"They also took a silver medal, filed down one half of it on either side, without touching the other half, till they reduced it to about the thickness of a playing-card. Then, taking half of a medal of gold, they split it, and reducing the two parts in the required proportions, adjusted the outside parts over the silver core, preserving the proper arrangement of the designer. They then had a whole medal, half silver and half gold, but with the gold part stuffed with silver. This, they said, was a silver medal which had not lain long enough in the elixir, and had only been partly transmuted.

"Half of a third medal was superficially gilded with an amalgam of gold, and represented a piece which, having been merely dipped into the elixir, had only begun to turn.

"When this game was played, the golden parts of the three pieces were whitened with mercury, so as to look as if they were all silver. To make the deception more complete, the performer, who should have a knack for conjuring, exhibited three genuine silver pieces that had not been tampered with, and permitted the audience to examine them. Taking them back, he slyly substituted his prepared pieces for them; fixed these in his glasses, poured in as much of his elixir as suited him, and withdrew them at the lapse of the designated intervals of time. He threw them into the fire and left them there long enough to drive away the mercury with which the gold was masked. Then he took them out, looking as if they were half of silver and half of gold; but with the difference that, in cutting the parts that seemed to be of gold, one was merely gilded on the surface, another was gold filled with silver, and the third was gold all through.

"Chemistry furnished these tricksters with other most subtle means of carrying out their deceptions. It was also possible to introduce another, lighter metal into gold, which, while reducing its weight to that of an equal volume of silver, would not change its color, or separate from it in any part of the process."—*Translated for the Popular Science Monthly from La Nature.*

MANY very curious features of language are exhibited in Dr. Leitner's book on the Hunzas of Dardistan. The substantive can not be used without the personal pronoun; as if we could say "my heart," "thy heart," or "his heart," but not "heart" by itself. The plurals of many feminine nouns are masculine, and *vice versa*. In the verb "to be" or "to become," as well as in numerous other verbs, there are different plurals for men, women, animals, etc., and the latter are again subdivided according to sex. Objects also are distinguished into male and female, according to their fancied stronger or weaker uses.

A LESSON IN CO-OPERATION.

By CLARENCE N. OUSLEY.

THE commercial method of the times seems to be the merging of competing enterprises into syndicates and trusts under a single management. Naturally enough a similar tendency is becoming manifest among producers as well as among manufacturing and transportation agencies. Various meetings and conventions among farmers of late have suggested the establishing of co-operative stores and exchanges controlled by a central bureau, which shall be the head of a gigantic farmers' pool. Indeed, the first steps to this end have already been taken in several Southern and Western States. In view of the event to which these signs point, it is not amiss at this juncture to interpose a lesson in co-operation furnished by the rise in 1887 and fall in 1889 of a large enterprise of this sort, viz., the Farmers' Alliance Exchange of Texas. It is not the purpose of this paper to discuss the expediency of such commercial ventures. The intention is merely to give an historical account of the particular case under examination, without even pointing a moral further than that which would suggest itself to any thoughtful mind—viz., like causes, operating under like conditions, will produce like effects.

The Farmers' Alliance of the Southern States, which was consolidated with other farmers' organizations at St. Louis in December last into the Farmers' Alliance and Industrial Union of America, had its origin in Texas several years ago. One of its original purposes, according to the declaration of its constitution, was "to develop a better state financially" among its members; and in pursuance of this purpose the Farmers' Alliance Exchange of Texas was organized. It was the first extensive business experiment under the Alliance movement, which had meanwhile spread over the South, and was therefore watched with considerable interest. At the annual meeting of the Texas Alliance, at Waco, in August, 1887, the following plan of business was adopted: 1. To incorporate the Farmers' Alliance Exchange of Texas. 2. To sell farmers' produce and to buy farmers' supplies as the farmers' agent, and to erect suitable buildings for conducting the business. 3. The capital stock to be $500,000, divided into twenty-five shares, controlled by twenty-five trustees elected by the State Alliance. 4. To raise the capital stock by assessing each member of the Alliance two dollars, and on receipt of $50,000 to credit each share with ten per cent paid in, and like credit to be made for each subsequent payment of the same amount. The twenty-five trustees were elected, and a State business agency, previously in operation on a small scale, was merged into the new enterprise. From this

time forward for several months there prevailed among the members of the order the most hopeful and enthusiastic spirit possible to imagine, amounting to almost a universal conviction that financial salvation was come.

The main body of the Alliance was composed of tenant farmers, who as a class farm on the "third and fourth," that is, by paying a third of the cotton and a fourth of the corn as rental for the land. They are possessed of little more than a meager household and farming equipment, and are generally compelled to mortgage the growing crop to the country merchant for the year's supplies of groceries, clothing, and implements. Their hope was to escape from the country merchant, who, to say the least, does not conduct his business on the plan of quick sales and small profits. To afford such escape was equally the design of the Exchange. It may be readily perceived, therefore, that the Alliance was wrought to the highest pitch of excitement in contemplation of abolishing the awful credit system which is a veritable millstone about the neck of the improvident farmer. In addition to the work of public lecturers sent out by the Alliance, several papers published in the interest of the order kept the Exchange topic red hot, while it was also a theme for discussion in the papers at large, so that the general public was in a state of greater or less expectancy. In connection with the Exchange it was announced by the Alliance organs and speakers that the movement would result finally—and not a very far off "finally" at that—in cotton and woolen mills, implement and wagon factories, a huge printing-house, etc. A plan was formulated also for establishing an Alliance University, with departments of law, medicine, and theology. From first to last several factories have been started, but without a single exception they have failed to reach the stage of successful operation.

Immediately after the Waco meeting of the Alliance, the twenty-five trustees met and delegated the transaction of business to a board of seven directors, which was organized by the election of the following officers: a president, secretary, treasurer, and a general business manager. Meanwhile a charter had been procured in accordance with the foregoing plan, and the establishment was located at Dallas, in consideration of $10,000 cash subsidy, a site for buildings, and other substantial inducements. The business was opened in September, 1887, in temporary quarters provided rent free by the citizens of Dallas. The published report of the manager for that month shows an expense account of $793.91 and a cash balance of $201.40, or total resources amounting to $991.31. This was a part of the $10,000 cash subsidy, which, though never quite paid in full, was practically discharged and furnished the available capital for some time.

The Exchange commenced business by handling cotton and grain, and farm implements. The former were sold after the plan of a regular commission-house; the latter were procured and furnished at good discounts by centering the trade direct to a wholesale dealer, who was nominally the Alliance implement agent, but in fact was selling on his own account. It was but a short time, however, until the business was extended to the buying and selling of dry goods, groceries, and general supplies.

Notwithstanding the lack of capital which appears from the business manager's reports, the Exchange was complimented by the mercantile public with a fairly good credit, and may be said to have commenced life under the most favorable circumstances. The financial statement for the forty-five days ending October 31st, is as follows:

Accounts and bills receivable	$9,962 51	
Office fixtures and furniture	202 20	$10,164 71
Liabilities.		
Accounts and bills payable	$9,511 24	
Total liabilities		$9,511 24
Net capital		$653 47
Losses.		
Expense account	$312 64	
Help account	1,588 82	
Total losses		$1,901 46
Gains.		
On bagging and ties	$79 65	
Interest and discount	1 80	
Commission account	493 41	
Merchandise	62	
Total gains		575 48
Net losses		$1,325 98
Investment	$201 40	
Received from donation, etc.	1,778 05	
Total capital	$1,979 45	
Deduct net losses	1,325 98	
Net capital		653 47

It will be observed that the September cash balance of $201.40 has been supplemented only by $1,778.05 "received from donation, etc.," which was mainly "donation" and little "etc."—that is to say, chiefly from the citizens' subsidy and almost nothing from stock subscription. The statement for November exhibits an increment of $1,122.40 from donation account, and practically nothing from stock, with a net capital of only $1,195.17, showing the business to be still operating at a loss.

At a meeting of the directors, November 5, 1887, a novel plan of business was adopted which became the central and chief

feature of the institution, becoming first the means of its sudden advancement, and later the cause of its sudden suspension. It is attributed, in the minutes of the meeting, to one of the directors, but probably owes its origin to the manager, who was the controlling spirit of the Exchange enterprise from its inception to the spring of 1889—the period of his management. The plan was briefly as follows:

1. Members of each Sub-Alliance, wishing supplies on credit, to furnish a schedule of their probable needs during the year, together with a showing of their full financial responsibility, and a pledge of cotton at least three times as much as the amount of credit.

2. These several members of each Sub-Alliance to execute a joint note for the estimated amount of supplies, said note to draw interest after May 31st and to be paid November 15th.

It was designed that these notes should be signed also by responsible farmers (if necessary to make them bankable), who would secure themselves against loss by taking mortgages on the growing crops. In this way the country merchant was to be avoided.

These joint notes acknowledged full consideration in the face, and were to be credited finally with the difference between the face and the actual credit account. The notes at first were accompanied by a sort of bond of corresponding number, issued by the Exchange, agreeing not to part ownership with the notes; but, upon the failure of the order during November and December to pay in any considerable amount of the capital stock, the available donation being then about exhausted, the notes were, by order of the board of directors in January, used as collateral security in borrowing money.

The business manager's report for the month ending January 31st showed $4,157.36 increase of capital during the month, or a total of $5,247.93. The months of January, February, and March constituted a period of great activity. The country was alive with lecturers in the joint employ of the State Alliance and the Exchange; "The Southern Mercury," organ of the order, had an extensive circulation, and the Exchange was issuing a semi-monthly circular letter containing private advice, discounts, etc. During this time the total capital was increased to $20,215.38; the amount of joint notes reached $200,974.88, on which goods had been advanced to the amount of $108,371.06.

An extract from the business manager's report for the month of March shows "the beginning of the end," the first embarrassments that soon culminated in a serious, not to say fatal, collapse:

"The business manager spent the whole of the month of March in trying to negotiate banking arrangements whereby a

loan could be effected at a reasonable rate of interest, to provide funds to purchase goods with which to supply the contracts accepted by the committee of acceptance; but all the efforts made were unsuccessful, and tended to produce the conviction that those who controlled the moneyed institutions of the State either did not choose to do business with us, or they feared the ill will of a certain class of business men who consider their interests antagonistic to those of our order and corporation. At any rate, be the causes what they may, the effort to borrow money in a sufficient quantity failed."

The month of April showed an increase in capital, from stock paid in, of $1,526.36. During the month of May maturing obligations failed to be met, notes of the Exchange went to protest, and general disaster followed, amounting almost to a total suspension of business. During all this time the most hopeful statements were made by the manager to the public, and the general fraternity were induced by official utterances to believe that the troubles of their business were precipitated by a combination of bankers and wholesale merchants to crush it out. A meeting of the State Alliance Executive Committee was called, and, after a few days of examination into the business at Dallas, the following call, signed by the seven directors, was issued:

Members of the Farmers' Alliance of Texas:

BRETHREN: Grave and important issues confront us to-day. Unjust combinations seek to throttle our lawful and legitimate efforts to introduce a business system more just and equitable than is now prevailing. . . . In order that the proof of the existence of this combination may be submitted to you, and that a full, free conference may be had with the brethren, it is most earnestly recommended that a mass meeting be held at the court-house in each county of the State on the second Saturday in June, at which meeting documentary evidence disclosing facts of vast importance will be laid before you, and a plan for your consideration and adoption. . . .

In addition to this, there was issued about the same time a secret circular, signed by the officers of the Exchange, which is so violent in language as to almost merit the adjective "revolutionary." The circular is too long for reproduction here, but the main points may be summarized as follow:

1. There was from the first a hidden, underhanded, masked opposition to the Exchange. 2. That Dallas bankers, wholesale merchants, implement dealers, and manufacturers entered into a combination to crush the Exchange; that the bankers refused to lend the Exchange money upon any terms or any security, and tried to force them to buy through jobbers. 3. That the Dallas combination "kept the mails full and the wires red hot" to prevent the Exchange from getting money at Fort Worth, Houston, Galveston, and New Orleans.

These utterances indicate the bitterness of feeling incited by the Exchange management and the officers of the State Alliance.

While the circulars were condemned by a few conservative spirits, and were subsequently regretted, probably, by all reasonable men in the order, at that time they were not publicly disputed except by outside parties. "The Texas Farmer," organ of the Texas State Grange, went to the trouble of interviewing prominent bankers and business men in Dallas, who uniformly denied the existence of any such combination, and affirmed their goodwill for the Exchange, attributing its failure to lack of business management. From the publication of these circulars, in May, to the 9th of June, the Alliance was in a state of violent excitement. In addition to the circulars and other publications, lecturers covered the entire State, and, by every possible argument and appeal, urged the members to take stock and save the business from final ruin. The effect was to raise only little less than $30,000, though subsequent fruits of the same canvass increased that amount to nearly $50,000. The statement for June shows a total capital invested of $56,409.26.

This call on the 9th of June, 1888, which became a memorable day in Alliance history, forcibly illustrates the weakness of such financial schemes as depend on popular subscriptions, or per capita assessments, with no other power of collection than the force of fraternal obligation. The membership of the Alliance in Texas had been frequently estimated by Alliance speakers and writers at 250,000, though it probably never reached more than half that number—if more, it all the more strongly illustrates the point. In speaking of the resources of the Alliance business, it was common with leaders to say that unlimited sums could be raised on call. For instance, an assessment of one dollar per capita would bring in, within thirty days, $125,000 (or $250,000, according to the highest estimate of membership). Here was a case of prime importance in which it was urged that not only the salvation of the business but the freedom of the farmer was at stake, and yet the total subscriptions, first and last, did not exceed $50,000.

Notwithstanding the disaster impending in the early spring, the board of directors at their March meeting entered into a contract for a building, to cost $34,117, which was in due time completed, though never one fourth paid for, and in April opened a branch Exchange in Belton, Texas. The Belton business received substantial inducements from citizens amounting to about $10,000.

It is unnecessary to further follow the business in detail. The June rally failed to raise the needful amount of funds to make the Exchange easy. Extensions were secured from time to time, and efforts were constantly made to raise the capital stock, but without material success. The Exchange never recovered from the wild

and extravagant methods of its first winter, and in the summer and fall of 1888 it was further crippled by attacks of "The Southern Mercury," the State Alliance organ, on its business management. This caused internal dissensions which threatened at one time to disrupt the order, creating two bitter factions, which for a long time refused to be reconciled. Early in 1889 the business manager of the Exchange resigned, and a new one was elected in his stead. Meanwhile there had been a change in the editorial management of the "Mercury," and the spirit of true fraternity soon reasserted itself, the order becoming again firmly cemented, though it had lost materially in members. However, the better part remained, and the Alliance has since been happily progressing in all that relates to social and economic education.

The management of the Exchange during 1889 was conservative and judicious, and, under other circumstances, he would doubtless have made it a successful enterprise, but it was too heavily encumbered, and the confidence of the order in it had been sacrificed. His report to the State Alliance, August, 1889, is as follows:

Resources.		*Liabilities.*	
Exchange building, Dallas....	$70,000 00	Bills payable on merchandise.	$44,704 42
Exchange building, Belton ...	12,000 00	Bills payable on buildings....	29,300 00
Exchange building, Longview.	9,000 00	Accounts payable.....	1,285 81
Live stock, Henrietta.....	7,500 00		$75,290 23
Merchandise, all points	50,238 00	Present net worth.....	104,557 77
Accounts and bills receivable, estimated good	39,210 00		$179,848 00
	$179,848 00		

Cash received and paid out.

Amount paid on old indebtedness.....	$34,103 43	
Amount received from sale of lands.....		$14,800 00
Amount received from capital stock		5,276 50
Merchandise sales and collections.....		14,026 93
	$34,103 43	$34,103 43

Report made to directors in January showed the mercantile indebtedness to be $46,000. The real fact is that it was $78,817.85.

The State Alliance, in August, 1889, passed a resolution providing for a voluntary trust fund of $75,000, or enough to discharge the entire indebtedness of the Exchange, but not to be used until raised in full. The trust fund never reached a third of the required amount, and in December last the Exchange building at Dallas was sold under mortgage for $35,000. Immediately thereafter the manager proceeded to wind up the affairs of the Farmers' Alliance Exchange of Texas.

To recapitulate: The Exchange commenced to do business

without capital, depending on donations and assessments, with no power to enforce collection. Instead of confining its operations to buying and selling as the farmers' agent, it attempted to take the place of the country merchants, and to furnish supplies on credit to all the farmers of Texas. To do this successfully would require millions instead of thousands. The reason the banks refused to lend money to the Exchange in March, 1889, was neither opposition to the Exchange nor undue friendliness to the jobbers, but plain business prudence. The Exchange was doing a larger business than its capital warranted; the joint notes used as collateral security were represented by accounts from twenty-five to seventy-five per cent less than the face of the notes, and while innocent purchasers could be protected in the courts, still litigation is a resort which every prudent business man tries to avoid; some of the joint notes were offset by bonds agreeing not to part ownership, while as a matter of fact they were placed in serious jeopardy by being put up as collateral security for extensive loans. The wisdom of these precautions was demonstrated in the final outcome of the Exchange's management.

In October last the representatives of the trust fund, which reached about $17,000, perceiving that it would be inadequate for the ends sought, met at Dallas and placed it in the hands of the manager, instructing him to save such part of the Exchange as might be possible. Since the sale of the building there has been organized a new corporation, composed of Alliance members representing the trust fund; and this new corporation, known as the Farmers' Alliance Commercial Agency, has purchased the Exchange building, and designs carrying on a general buying and selling agency. It is to be hoped that the new enterprise will be more successful than the old one was.

According to Oudeman's review of parallax investigations, the distance of forty of the fixed stars has been approximately determined. The disproportion between this number and the number of stars of which we know nothing is so great, says Mr. A. M. Clarke, that general conclusions seem discredited beforehand, and negative ones can have no weight. But it is evident that the largest stars are not always those nearest to the earth. Seven of those whose distances have been ascertained are invisible to the naked eye, while one is nearer than Sirius, and all are nearer than Capella, Vega, Arcturus, or Canopus. A further conclusion may be deduced that the disparities between the stars are enormous. "A farthing rush-light is not more insignificant compared with the electric arc than a faint star compared with a potent sun. Sirius emits 6,400 times as much light as the ninth-magnitude star 11,677 Argelander-Oelzen; and our own sun is nearly as much inferior to Arcturus. Inequalities of the same order appear between the members of revolving systems; as, for instance, Sirius shines like four thousand of his companions."

INTELLIGENCE OF SQUIRRELS.*

By Dr. T. WESLEY MILLS,
PROFESSOR OF PHYSIOLOGY IN MCGILL UNIVERSITY.

UNTIL recently, the habits of animals seem to have been considered simply as interesting manifestations of their life, but without any special reference to their relations to the intellectual part of the creatures concerned. But unless we assume that animals are devoid of mind and true intelligence—an extreme and untenable position—there must be a possible science of comparative psychology, as there is of comparative anatomy and physiology. The study of animal intelligence is possible, interesting, and important, whether we regard man as derived from some lower form, and his intellectual as well as his physical being the result of evolution; or whether we consider that man stands wholly apart in origin either as to body or mind. In the latter case, the study of the lower forms of mind affords a useful contrast with its highest development as seen in man; in the former, we aim at the construction of a ladder by which we may climb from the simplest manifestations of consciousness to the highest performances of the most gigantic human intellect.

I have selected the study of squirrel psychology as the subject of this paper, because so little seems to have been written on the subject; because these animals are open to the observation of every one; and chiefly because I have been able to give special attention to them myself. Their habits will be considered principally, but not exclusively, from the psychological standpoint; and I shall apply the comparative method, making such references to the habits and intelligence of other rodents as seem to throw light on those of the squirrel. While some attention has been paid to other species of squirrels, my studies have been chiefly on the ground squirrel (*Tamias Lysteri*) and the red squirrel (*Sciurus Hudsonius*).

These species, in many respects, form a contrast to each other. The chipmunk, chipping squirrel, or hackee, has his abode underground in a specially constructed burrow; the red squirrel, or chickaree, lives in nests in trees; and the intelligence of the latter seems to be altogether of a much higher order than in the ground squirrel. This was abundantly illustrated in my experiments with an ordinary wire rat-trap having a spring door. The trap was scarcely laid down near the haunts of the chipmunk before one entered it, in fact before my eyes; and there was never any difficulty in securing as many as were wanted. On several occa-

* Part of a paper communicated to the Royal Society of Canada.

sions, when one had escaped in the room, on placing a small apple in the cage, the creature re-entered it almost at once.

Very different was it with the red squirrels; at first they entered the trap, but not afterward. They approached it, sometimes two or three together, ran round it on the upper rail of the fence on which it was placed, or sat on top of it—in short, did everything but enter it—all the while seeming to enjoy the whole greatly.

Having secured a couple of ground squirrels in the manner described, I kept them under observation for the period during which they survived, viz., one for about a month and the other for between two and three months. From the first, one of them seemed to take more kindly to his new surroundings than the other; one appeared shy and dull, while his fellow seemed as happy as any chipmunk might be. They were captured in September, and it has often occurred to me that their habit of hibernation had something to do with the behavior of the one, though we should expect that, in such a matter, both would be equally or considerably affected. The degree to which, while retaining their original habits, the latter became modified in confinement, furnished me with an interesting study, and suggested many problems. My experience does not agree wholly with that of Audubon and Bachmann, who say, in their "Quadrupeds of North America," "We are doubtful whether this species can at any time be perfectly tamed." The one of my chipmunks that survived longest became in a short time so tame that he would eat from the hand, and even looked to be fed in this way. True, any noise, or any unusual movement, might startle the creature, when he would make the quick dart away so characteristic of the species in the wild state. But from this he very quickly recovered, and the tendency to be thus frightened grew less and less. The authors referred to also state that "they appeared to have some aversion to playing on a wheel, which is so favorite an amusement of the true squirrels." This does not at all agree with my observations; for though at first my chipmunk was apt to be startled when he found the revolver of his cage moving on his entering it, he soon got used to it, and delighted in it as much as any squirrel could—in fact, he used it by night and by day, manifesting an ability to control it which speaks much for the readiness with which such animals adapt themselves to new and difficult movements, and which shows how highly developed those parts of the brain must be which are concerned in the balancing and kindred functions. I may here correct another statement of the same authors. They maintain that squirrels do not lap fluids as the dog and cat. From repeated observations I know this to be an error, at least so far as the ground squirrel is concerned.

It has usually been assumed that squirrels, and indeed most rodents, feed wholly on vegetable food, and that in those instances in which the contrary has been observed there was evidence of a perverted or morbid appetite. Audubon and Bachmann, however, state that the flying squirrel (*Pteromys volucella*, Des.) has been caught in traps baited with meat. A number of writers,* especially within the past few years, have drawn attention to flesh-eating habits in several rodents, mostly under peculiar circumstances. Some interesting questions arise in this connection: 1. In how far is any rodent carnivorous, when abundance of all the different kinds of vegetable food that the animal uses is at hand? 2. What is the relation between confinement and altered appetites? 3. In how far are such altered appetites evidence of morbid or perverted conditions, and in how far simply the expression of physiological needs? The whole subject, I am inclined to think, might be placed on a broad and sound physiological foundation; but, before that can be done, many accurate observations are required, and possibly also many series of experiments. If we may judge by the common house rat, rodents possess unusual plasticity as to feeding and other habits, and not less as regards their mental life. I found that my chipmunk would take a great variety of foods, though the experiment of feeding with meat was not tried. He drank milk greedily.

There is one peculiar habit, interesting from a physiological point of view, to be observed in squirrels in confinement. A writer in "Nature" (vol. x) says, "I have noticed that whenever it [the squirrel] cleans itself, after licking, it sneezes violently three or four times into its fore-paws, then rubs them thus damped over its fur." And this writer raises the question as to whether this habit, which he believes voluntary, was confined to squirrels. He does not mention what sort of a squirrel his own was; but I have noticed this behavior as of most frequent occurrence in my caged chipmunk. It seems to me, on the whole, most natural to consider it a voluntary act of the same character, and possibly for a similar purpose, as cleaning the throat in the human subject, or perhaps even blowing the nose. And I am the more inclined to believe that it is voluntary, from the account given of the flying squirrel, as observed by Prof. G. H. Perkins and recorded in "The American Naturalist" (vol. vii). This writer states that on one occasion his squirrel lapped some ink, but shortly afterward manifested disgust and indulged in violent sneezings. Under these circumstances it is difficult to understand, by anything in our own experience, how the act could have been reflex.

Speaking of the relative intelligence of squirrels, this writer says, "I am inclined to believe that the flying squirrel does not

* "Science," vol. viii; "Canadian Naturalist," vol. iii.

possess as much intelligence as the gray or red or some other species." From the entire account of the flying squirrel given by Prof. Perkins, I should suppose that the intelligence of this species and that of the ground squirrel are about on a par—the explanation of which will be considered later.

A question of much interest to the naturalist and psychologist, it seems to me, is the following, viz., to what extent the intelligence of animals that hibernate has been modified by this process, and in what directions. With regard to hibernation, so far as the squirrels are concerned, there seems to be great dearth of accurate observations; in fact, the same remark applies to the whole subject of hibernation, one of the most interesting in the whole realm of physiology. A number of observations are to be found scattered through the literature, but they are fatally lacking, in most cases, in precision of observation and accurate record of dates. From a short but valuable paper on "The American Chipmunk," in "The Popular Science Monthly" (vol. vii), by Dr. C. Abbott, we are led to believe that the ground squirrel spends some time in his burrow before hibernation begins, and that the food laid up is consumed in part before the winter torpor sets in, and more especially in the spring before a fresh supply is obtained in the usual way. Concerning the winter habits of other species, I have been able to learn nothing from any quarter that definitely settles the question as to whether they hibernate or not. Audubon and Bachmann (*loc. cit.*) state that as much as one bushel and a half of nuts has been found in a single hollow tree occupied by a chickaree or red squirrel. They also state that this species may have several hoards. From different remarks dropped by these writers, from what I have myself observed, and from the statements of Dr. R. Bell, I am inclined to the belief that the red squirrel and some other species do not regularly hibernate the whole winter through. But whether they hibernate at all, in the true sense of that term; whether they have short periods of hibernation, followed by intervals of consciousness, during which they feed; whether they remain in a condition of partial torpor, with slowing of all the vital processes, and yet not in absolute insensibility and with cessation of respiration, etc.—all these questions seem to be as yet wholly undecided.

It has long been known that many cold-blooded animals hibernate and, under altered conditions, æstivate; it is further believed that among warm-blooded animals, besides bats, many rodents and some allied animals hibernate. But, when the matter is looked into carefully, it is found that the term "hibernation" has been used in a loose and very plastic sense by different authors. It is highly desirable, therefore, that writers should state exactly to what extent the animal they describe as "torpid," "hibernat-

ing," or "in winter-sleep," deviates functionally from the normal; also, that the exact time of the observations be recorded. There is a certain amount of evidence that even birds, representing the highest type of activity, may possibly hibernate; and that many animals, not usually thus affected, may become so under exceptional circumstances—indeed, that man himself, owing to peculiar states of the nervous system, may pass into a condition ("trance") having much in common with the hibernation of lower animals. I think it is very probable that, when the matter has been fully investigated, all degrees of cessation of functional activity will be found represented, from the normal daily sleep of man and other animals, to the lowest degree of activity consistent with the actual maintenance of life. The flying squirrel is nocturnal in habits and exceedingly active, even in confinement, as Prof. Perkins (*loc. cit.*) has shown; but during the daytime it seems not to be correspondingly quick—in a condition, in fact, resembling somewhat that of a hibernating animal. The "diurnal hibernation" of the bat is not to be forgotten. I noticed that my chipmunk invariably, after feeding, tucked his head down and assumed a more or less ball-like form highly suggestive of a tendency to hibernation.

There are many questions that arise in connection with this subject, one of which bears directly on the subject of comparative psychology: How and to what extent is the intelligence of animals influenced by hibernation? It may be considered pretty clear that both the ground squirrel and the flying squirrel hibernate, and these are certainly among the lowest—perhaps are actually the lowest—in intelligence of the whole tribe. We know that struggle among higher animals develops mental adaptation and other forms of intelligence, and it is rational to suppose that those species of squirrels that do not hibernate throughout the winter, but endeavor to prevail over their surroundings, as well as to adapt themselves to them, should be more intelligent than those spending a large portion of each year in inactivity.

My chipmunk, during its captivity, under certain circumstances, kept to his original habits—e. g., when a single nut was given him he would eat it immediately, but if several were presented at once he would hide them one by one in a corner of his cage, or, if sufficiently small, pack them away in his cheek-pouches. He did the same with cereal grains. When cotton wool or web-like material was placed in the cage, he manipulated it a good deal, but finally made a bed of it, in which he buried himself out of sight.

Within the last ten years attention has been called to "singing" in certain rodents, especially mice; but from numerous references in the literature it appears that "singing," or something

analogous to it, has been noticed in a large number of rodents.* The well-known note of the chipmunk, from which it has derived its name, is the only one I have heard from it. After studying a colony of red squirrels for some weeks last summer, I came to the conclusion that they have a capacity of vocal expression much greater than is commonly believed. Their usual "barking," or trilling, seems to be the commonest, the most instinctive, and not largely expressive of anything beyond general satisfaction; but I found that, under excitement, there were many other tones, associated with great complexity of emotion, which I am not prepared to analyze, but which there can be little doubt the creatures themselves employ as a means of intercommunication. Under marked excitement, as the result of repeated interferences, I have heard a red squirrel so mingle tones of a musical kind that a stranger, arriving on the spot, would certainly have been deluded into the belief that he was listening to some bird, or rather to an excited pair of birds. The musical character of this combination, together with its continuity and complexity, would perhaps justify the designation "song." One of the writers on musical mice refers to their singing but little in certain instances, except when excited, which is a point of analogy with the chickaree.

It would appear, therefore, that it is likely that, throughout the order *Rodentia*, a genuine musical appreciation and executive capacity exists, and in some instances in a very high degree; and that apart from this there is also considerable ability displayed in the expression of states of emotion, at least, by vocal forms. Manifestly, the degree to which animals can express their psychic states—and especially in vocal forms—is a matter of the greatest importance, and I have already elsewhere ("Popular Science Monthly," March, 1887) expressed my conviction that animals have a power of communicating with each other, altogether beyond what has been generally surmised. The subject is beset with great difficulties, and calls for the closest observations.

THE reviewer, in "The Academy," of Dr. Oliver Lodge's "Modern Ideas of Electricity" emphasizes the promise implied in the present state of scientific research and mathematical investigation that some great step forward is about to be made. "It is because the scientific world," he says, "knows itself to be on the verge of discoveries as to the nature of the ether, more far-reaching possibly than the discovery of the mode of gravitation, that it lives in a state of suppressed excitement, which hinders it sometimes from further progress or from recognition of the relative importance of recent work"; and he hints that the century which produced Darwin is now ripe for almost a greater genius than he. A similar tone is sounded in Prof. Lodge's book.

* See especially "Nature," vol. xv, "Popular Science Monthly," vol. i, and "The American Naturalist."

SKETCH OF DAVID RITTENHOUSE.

"AS a citizen of Pennsylvania," says William Barton, in the preface to his "Memoirs of the Life of David Rittenhouse"; "as an inestimable public and private character; as a distinguished son of science, of great probity and extensive usefulness in society—in all these points of view, the history of Dr. Rittenhouse may be contemplated as holding a relationship with almost every object connected with science and art in his day that could in any way contribute to the well-being of mankind in general and his native country in particular." He, in fact, acquired a fame in the period of the infancy of American science, the nature and extent of which can hardly be realized in this day; and his gifts, then regarded as extraordinary, were always freely placed at the service of the public.

DAVID RITTENHOUSE was born in Roxborough Township, near Germantown, Pa., April 8, 1732, and died in Philadelphia, June 26, 1796. He was descended from a family of paper-makers residing at Arnheim, Guelderland. His great-grandfather, William Rittenhouse, a Mennonite preacher, came from Holland with his family in 1687–'88; was the first Mennonite minister in Pennsylvania; and established the first paper-mill in this country, at the spot where David was born.

David was early put to work on the farm, and was plowing at fourteen years of age. An uncle dying had left him a chest of tools and a few books on arithmetic and geometry, with some manuscript mathematical calculations. These furnished palatable food to his mind, and his biographers tell of his having covered the handle of his plow and the fences around the field with his workings of the problems which they set before him. As the uncle mentioned above was his mother's brother, it is inferred that he inherited his genius from his mother's side. His mechanical talent was shown in his construction of a complete water-wheel in miniature when eight years old, a wooden clock when seventeen, and a clock with metallic works at a later age. His father was not disposed at first to favor the youth's tastes, but eventually he furnished him with money enough to buy a set of clock-making tools; and David built a workshop at Norriton, whither the family had removed, where he carried on the clock-making business for several years. He at the same time pursued his studies so diligently that he impaired his constitution, and contracted a pain that afflicted him all his life. Astronomy appeared to be his favorite study; and he was interested in optics and mechanical science. He discovered himself, independently, the method of fluxions, of which, in his imperfect knowledge of what Newton and Leibnitz had

done, he believed himself to be the originator; and mastered the English translation by Motte of Newton's "Principia."

The acquaintance which he formed in 1751 with Thomas Barton, who afterward married his sister, had an important influence in shaping his career. Rittenhouse, according to William Barton, "possessed a sublime native genius; which, however, was yet but very imperfectly cultivated for want of indispensable means of extending the bounds of natural knowledge." Barton had enjoyed these means, and had acquired the reputation of being a man of learning. He found Rittenhouse's society profitable, and Rittenhouse found his equally so. Barton aided Rittenhouse greatly by helping him to the books he needed. Partly through his instrumentality a circulating library was established at Norriton; and he bought books for Rittenhouse when he went to Europe.

Mr. Rittenhouse was called upon in 1763 to determine the initial of the boundary-line between Pennsylvania and Maryland, his particular duty being defined to be to ascertain and fix the "circle to be drawn at twelve miles' distance from New Castle, northward and westward, with the beginning of the fortieth degree of north latitude," etc. The work was an arduous one, and involved going through a number of tedious and intricate calculations. It was performed in a satisfactory manner, for which acknowledgment was made in the shape of extra compensation, and with instruments to a large extent of Rittenhouse's own making; and his observations were accepted without change by the official astronomers, Mason and Dixon, when they took charge of the work. He was afterward appointed to a similar work in 1769, by the commission to settle the boundary between New York and Pennsylvania. Among his scientific studies at this period were the investigation of variations in the oscillations of the pendulum under changes of temperature, with the device of a plan for compensation, and the construction of what he called a metalline thermometer. This instrument was so made—on the principle of the expansion and contraction of metals under variations of temperature—that the degrees of heat and cold were indicated by the movements of an index moving along a graduated semicircle. It was adapted, in form and size, to be carried in the pocket. He discussed the compressibility of water in the light of an experiment that had been reported to the Royal Society, and observed, in a letter to Mr. Barton, that, although the experiment did not please him, he did not doubt the fact; for, "if the particles of water were in actual contact, it would be difficult to conceive how any body could much exceed it in specific gravity; yet we find that gold does, more than eighteen times." We find him also at this time (1767) indulging in some amusing speculations on the possibility of a man's moving the world.

Some one having published the result of calculations he had made respecting the fulfillment of Archimedes's famous *dictum* on the subject, Mr. Rittenhouse gave the result of his own computations, which was that "the force wherewith a man acts when he lifts a weight of two hundred pounds, if applied without intermission for the space of one hundred and five years, is sufficient, without any machinery, to move the earth one inch in that time; and it must, from the velocity received by that force alone, continue forever after to move at the rate of one inch in fifty years." The first calculator had computed that twenty-seven billions of years would be required to accomplish the movement.

Mr. Rittenhouse's reputation as an astronomer became conspicuous, and his name, according to Mr. Barton, acquired a celebrity even in the Old World, "of which his early but now much-increased fame in his native country was a sure presage." A great bound was given to his fame by his construction of an orrery, or apparatus for illustrating the planetary motions, and by the conspicuous part which he took in the observations of the transit of Venus of 1769.

The design of the orrery is indicated in the correspondence with Mr. Barton in 1767, in the course of which Mr. Rittenhouse says: "I did not design a machine which should give the ignorant in astronomy a just view of the solar system; but would rather astonish the skillful and curious examiner by a most accurate correspondence between the situations and motions of our little representatives of the heavenly bodies and the situations and motions of those bodies themselves. I would have my orrery really useful by making it capable of informing us truly of astronomical phenomena for any particular point of time, which I do not find that any orrery yet made can do."

This instrument was bought before it was finished for Princeton College. The trustees of the College of Philadelphia had also been bargaining for it, and were disappointed over the turn the affair had taken. Mr. Rittenhouse had made a saving clause in his bargain in favor of the College of Philadelphia, in agreement with which he began another orrery for that institution. "This," he said, "I am not sorry for, since the making of the second will be but an amusement compared with the first; and who knows but that the rest of the colonies may catch the contagion?" The sum of two hundred pounds was obtained toward paying for the instrument by means of lectures on astronomy delivered by Rittenhouse's friend, the Rev. Dr. Smith, Provost of the College of Philadelphia, concerning which the Rev. Dr. Peters wrote, "The doctor in his introductory lecture was honored with the principal men of all denominations, who swallowed every word he said with the pleasure that attends the eating of the choicest viands,

and in the close, when he came to mention the orrery, he over-excelled his very self." The members of the Assembly of Pennsylvania took a view of the orrery, and, "being of the opinion that it greatly exceeds all others hitherto constructed, in demonstrating the true Situations of the celestial Bodies, their Magnitudes, Motions, Distances, Periods, Eclipses, and Order, upon the principles of the Newtonian System," voted the constructor three hundred pounds in consideration of his mathematical genius and mechanical abilities, and appointed a committee to agree with him for a new orrery for the use of the public. This purpose was not carried out. Mr. Rittenhouse became engaged in public enterprises, which occupied his time till the beginning of the Revolution, when all other interests were suspended.

The praises which were bestowed upon Mr. Rittenhouse for his orrery were extravagant, and seem now even absurd; but nothing, perhaps, can more clearly illustrate the infantine condition of American science at the time.

Mr. Barton, by way of emphasizing the assertion that the skill and accuracy he displayed in the construction of his mathematical and astronomical instruments were not surpassed by similar works of the most celebrated British mathematicians, remarks that "his profoundness in astronomical science and his wonderful ingenuity, manifested in the construction of his orrery, leave him without a rival in the twofold character of an astronomer and mechanic." Dr. Jedediah Morse, in his "Geography" (1789), noticing some of the more prominent productions of scientific ingenuity and skill in America, observed that "every combination of machinery may be expected from a country, a native son of which, reaching this inestimable object in its highest point, has epitomized the motions of the spheres that roll throughout the universe." Mr. Thomas Penn, of London, was surprised that the instrument could have been executed in Pennsylvania. Joel Barlow wrote, in the "Vision of Columbus":

> See the sage Rittenhouse, with ardent eye,
> Lift the long tube and pierce the starry sky;
> Clear in his view the circling systems roll,
> And broader splendors gild the central pole;
> He marks what laws th' eccentric wand'rers bind,
> Copies Creation in his forming mind,
> And bids beneath his hand in semblance rise,
> With mimic orbs, the labors of the skies.

Thomas Jefferson, the sober statesman, Mr. Rittenhouse's successor as President of the American Philosophical Society, wrote, in his "Notes on Virginia," in refutation of the Abbé Reynal's assertion that America had "not produced one able mathematician, one man of genius in a single art or science": "We have

supposed Mr. Rittenhouse second to no astronomer living; that in genius he must be the first, because he is self-taught. As an artist he has exhibited as great a proof of mechanical genius as the world has ever produced. He has not, indeed, made a world; but he has by imitation approached nearer its Maker than any man who has lived from the creation to this day."

A committee of thirteen persons was appointed by the American Philosophical Society early in 1769 to view the transit of Venus, which was to occur on the 3d of June—a phenomenon which had been scientifically observed only twice before. This committee was divided into three, for observation at three stations—Philadelphia, Mr. Rittenhouse's home at Norriton, and the lighthouse near Cape Henlopen. Three other observers were associated with Mr. Rittenhouse at Norriton. An observatory was furnished, and the preparations and calculations preliminary to taking the observations were made by Mr. Rittenhouse. Some instruments were bought for the other stations. For Norriton a reflecting telescope was furnished by Mr. Maskelyne, Astronomer Royal at Greenwich—afterward given to the Philadelphia College—an astronomical quadrant by the Earl of Stirling, of East Jersey; and an equal-altitude instrument, a transit telescope, and a timepiece were made by Mr. Rittenhouse. The results of the observations were communicated to the American Philosophical Society, and a report of them was furnished to Mr. Maskelyne, who declared that they seemed excellent and complete, and did honor to the gentlemen who made them and to those who promoted the undertaking. The whole affair, in fact, gave the observers great credit abroad, and was regarded as promising well for the future of American science. The importance of the observation may be judged from the fact that it furnished one of the elements for verifying the great astronomical unit—the earth's distance from the sun.

On the 9th of November following this observation a transit of Mercury—the fourth ever witnessed—was observed at Norriton by Mr. Rittenhouse and his fellow-astronomers, and a report on the subject was filed with the Philosophical Society. Shortly after this the difference of the meridians of Norriton and Philadelphia was determined by a committee, of which Mr. Rittenhouse was one, at the request of Mr. Maskelyne, who wished to connect the observations of the longitude of Norriton with those made by Messrs. Mason and Dixon in the course of measuring the degree of latitude.

About this time a scheme was started by Dr. Smith to induce Mr. Rittenhouse to remove to Philadelphia. Recommending him for appointment as a trustee of the Loan Office, then before the Assembly, Mr. Smith represented to the Speaker that he "ought

to be encouraged to come to town, to take a lead in a manufacture, optical and mathematical, which never had been attempted in America, and drew thousands of pounds to England for instruments, often ill-finished; and it would redound to the honor of Philadelphia to take a lead in this, and of the Assembly to encourage it." The proposition was received enthusiastically, and the whole house rose to vote for Mr. Rittenhouse, one of the members exclaiming, "Our name is legion for this vote." The Assembly adjourned, however, without passing the bill, although Mr. Rittenhouse was afterward appointed to the position for which he was named in it. He removed to Philadelphia, on his own account, in the fall of 1770. The next scientific investigation in which he appears to have been engaged was the observation of the comet of 1770, of which he calculated the elements, and communicated the results to the American Philosophical Society. We afterward find him, with several other gentlemen, making experiments on the electric eel for the purpose of ascertaining the origin of the shock which the animal emits on being touched.

From this time on, Rittenhouse was to a considerable extent engaged in works in the service of the public, to some of which he was called in consequence of his scientific ability and mechanical skill, to others commended by his character as a citizen and his integrity. He was given charge of the State-House clock; appointed to survey the lands between the Susquehanna and Delaware Rivers; to superintend the improvement of the Schuylkill; and to determine the northwestern extremity of the boundary between New York and Pennsylvania.

In 1775 the American Philosophical Society presented to the Pennsylvania Assembly a plan for the erection of an observatory under State control, with Mr. Rittenhouse as "public astronomical observer"; describing him as "a gentleman whose abilities, speculative as well as practical, would do honor to any country. . . . Under his auspices the work could now be undertaken with the greatest advantages; and others may be bred up by him, to prosecute it in future times; but, if the present opportunity is neglected, perhaps whole centuries may not afford another. To rescue such a man from the drudgery of manual labor, and give him an occasion of indulging the bent of his genius with advantage to his country, is an honor which crowned heads might glory in; but it is an honor also, which it is hoped, in the case of a native, Pennsylvania would not yield to the greatest prince or people on earth." The Revolution came on, and the scheme was not carried out.

In view of that crisis, Mr. Rittenhouse was commissioned to prepare molds and have iron clock-weights cast, to be exchanged with the people for their leaden ones; as engineer to the Com-

mittee of Safety, to arrange for casting cannon; to view a site for the erection of a Continental powder-mill; to conduct experiments for rifling cannon and musket balls; to devise a method of fastening a chain for the protection of the river; to superintend the manufacture of saltpeter, and to locate a magazine for military stores. He was a member of the Committee of Safety in April, its vice-president in August, and its presiding officer in November, 1776. In 1776 he was a member of the Assembly from Philadelphia, and a member of the first Constitutional Convention of Pennsylvania; a member of the Board of War; and one of the Council of Safety, which had absolute powers. He was the first State Treasurer of Pennsylvania, from 1777 to 1789, when he declined to serve any longer. He was the first Director of the United States Mint, serving for three years from 1792; and he was called upon on several occasions to serve on commissions for the adjustment of boundaries. In connection with these public employments we find a curious letter from Mr. Jefferson to Mr. Rittenhouse, written in 1778, protesting against his wasting his abilities on affairs of state. "I am satisfied," he says, "that there is an order of geniuses above that obligation [to conduct government], and therefore exempt from it. No one can conceive that Nature ever intended to throw away a Newton upon the occupations of a crown. It would have been a prodigality for which even the conduct of Providence might have been arraigned, had he been by birth annexed to what was so far below him. . . . I doubt not there are in your country many persons equal to the task of conducting government; but you should consider that the world has but one Rittenhouse, and that it never had one before."

Mr. Rittenhouse was Professor of Astronomy in the University of Pennsylvania from 1779 till 1782, and was a trustee of the institution, continuing in that office after its reorganization in 1791. He was made one of the secretaries of the American Philosophical Society in 1771; became its vice-president in 1786; and succeeded Benjamin Franklin as president, on his death in 1790. He was elected a Fellow of the American Academy of Arts and Sciences in 1782, and an Honorary Fellow of the Royal Society in 1795. He received degrees from the College of Philadelphia, William and Mary College, and Princeton College.

He was tall and slender, quick in gait, had a countenance "indicative of intelligence, complacency, and goodness," and a disposition and manners that secured him friends and kept them. He bore testimony against the slave trade, and sympathized with the original motives of the French Revolution to such an extent that he assisted in the organization of the Democratic Society, and was made its president—but this was before the excesses of the Revolution were committed. While he

might be called self-educated, he was not, as Mr. Barton shows, wholly without assistance in pursuing his studies, although some writers had mistakenly affirmed this, but that assistance was small. Dr. Rush assumed, in the eulogy he pronounced upon him, that the eminence he attained was to be ascribed "chiefly to his having escaped the pernicious influence of monkish learning upon his mind in early life"; otherwise, "instead of revolving through life in a planetary orbit," he might have spent his time "in composing syllogisms, or in measuring the feet of Greek and Latin poetry." He understood the German and Low Dutch languages, acquired a reading knowledge of French, and "overcame in a great degree the difficulties of the Latin tongue." He was a firm believer in the Christian religion, though he was not attached to any church. That speculative disquisitions were of little interest to him is shown, perhaps, as much as by anything, by his remark concerning a conversation with a clerical gentleman, that it was "not, perhaps, greatly to the satisfaction of either of us; for he appears to be a mystical philosopher, and I, you know, care not a farthing for anything but sober certainty in philosophy." He published but little, because, as his biographer believes, he was too busy with work to give his time to the composition of formal papers. The list of his contributions to the American Philosophical Society includes twenty-two titles of papers relating to his orrery; the transits of Venus and Mercury; the comet of 1770; a method of deducing the true time of the sun's passing the meridian; the difference of longitude between the observations of Norriton and Philadelphia; an explanation of an optical deception; experiments on magnetism; a remarkable meteor seen in 1779; a comet observed in 1784; a new method of placing the meridian mark; an optical problem; astronomical observations (on the Georgium Sidus and a transit of Mercury); an account of several houses struck with lightning; another account of the effects of a stroke of lightning; several astronomical observations described in a single paper; a mathematical problem; a comet observed in 1793; the improvement of time-keepers; the expansion of wood by heat; a problem in logarithms; and the mode of determining the true place of a planet in an elliptical orbit—his last paper, read February 5, 1796. To these is added his oration on "Astronomy," delivered before the American Philosophical Society, on the 24th of February, 1775, and inscribed "To the delegates of the thirteen United Colonies." In this oration, three years before the announcement of Mayer's discovery of the proper motion of certain stars, and six years before Herschel's discovery of Uranus, the author put forth the suggestion, which has since proved a presage, that the fixed stars, and particularly the milky way, would afford fruitful fields of observation.

CORRESPONDENCE.

MORAL INSTRUCTION IN OUR PUBLIC SCHOOLS.

Editor Popular Science Monthly:

IN "The Popular Science Monthly" for January I read with much interest, but not surprise, an article by Benjamin Reece, on "Public Schools as affecting Crime and Vice." The author very clearly shows that our school system is not elevating the moral standard of the rising generation, as had been so sanguinely expected, but rather, that as the minds of the masses are increased in knowledge, there is an equal if not more rapid increase of vice and crime. But the root of the evil is not in the system of public instruction, for, as a general rule, no teacher is given a school who does not bear an exceptionally good moral character, and a majority of them are members of good standing in the various churches. With this guarantee for the moral training of the pupils by precept and example on the part of the teachers, it seems to me that all is being done in that line that can be done. Furthermore, the Sunday school, where moral training is especially attended to, is now considered an indispensable adjunct to every church; yet, with all this, vice and crime are on the ascending scale, and in a most astonishing degree.

It is a mistaken notion that simply to educate a people is to improve them morally; for a man can possess the most exalted moral qualities without the least intellectual culture, and *vice versa*. Now that our ethical hopes in public-school education are not fulfilled, what shall be further done to lessen this dark cloud of vice and crime? My answer is, we must combine other lessons with our present system of moral teachings, and these other lessons must be ethical object-lessons. Man, to a very large degree, is an imitative creature, and especially so in childhood. By constant imitation of what he sees others do, habits are formed, and, once formed at that early period, be they good or bad, are rarely, if ever, entirely suppressed in after-years. All the ethical subject-lessons may be given him that is possible; but if there be object-lessons that go counter to them, these invariably take the deeper root, and soon nullify or supplant the former.

With these truths before us, is it not the imperative duty of all—all who wish for good government, safety of person and property, and the advancement of the race—to become bright and living ethical object-lessons to the rising generation? Nor is this all that is to be done: we should discountenance and remove all who are not ethical object-lessons worthy of study. Man's imitative propensity is called forth principally by those whom he thinks are his superiors. Consequently all those in high places of all kinds who are pernicious object-lessons should be the first to be removed; for, if the source be putrid, the onflowing stream becomes foul also. The author, in the article referred to, very truly tells us that the fall of the Roman Empire was "an effect of a moral ruin." Now, all readers of Roman history know that the germ of this "moral ruin" had its birth in the topmost strata of Roman society; and the masses, with ready imitativeness, became rotten to the core. The sad *finale* of that wonderful empire we all know.

Is Roman history now preparing to repeat itself in these United States? The indications all strongly point that way. Do we not see venality and corruption pervading, more or less, every branch of the Government? Even our halls of justice are frequently tainted with it, while the politicians and office-seekers, with scarcely an exception, are prostituting the elective franchise throughout the land by a venal use of the "almighty dollar." This bribe-money is brought to bear almost exclusively upon the needy poor—making their pockets heavier, but dwarfing their moral manhood. With this state of things, is it to be wondered at that vice and crime are rolling up in billows mountain-high? Is it to be wondered at that our public schools, our Sunday schools, and pulpits are impotent to check the approach of this "moral ruin"? Nor can it be checked until the wise and the good throughout the land determine to elevate to places of honor and trust only those who are calculated to make the best ethical object-lessons for the study of the rising generation. How many can we point to who now sit in high places that would make good object-lessons for the study of all our school children? Purify the fountain, and the stream will become likewise limpid and pure.

E. P. MEREDITH.

ATLEE'S STATION, HANOVER COUNTY, VA., *January* 27, 1890.

POLITICS AND FARM MORTGAGES.

Editor Popular Science Monthly:

SIR: It was a gloomy picture of the condition and prospects of agriculture in the United States which Mr. Joel Benton drew in his article entitled "The Decadence of Farming," in the November "Monthly." A similar view is presented by Judge Nott, in a series of articles published by the New York "Evening Post;" while recent reports of the State Commission-

er of Agriculture of Vermont and of New Hampshire substantiate these accounts as regards those two States. Abandoned farms in the East and farm-mortgage foreclosures in the West, Mr. Benton tells us, are becoming distressingly common, and many farmers who still hold and work their lands are struggling along under increasing indebtedness, or at best obtain only rapidly diminishing returns.

Certain of our public men, however, deny that agriculture in the United States is suffering such a severe depression as these statements indicate. The Hon. Philetus Sawyer, Senator from Wisconsin, has said, according to the "Milwaukee Daily Journal," that he had never known of but one foreclosure of a farm mortgage in his section of the country, and the remark was used in debate in the Senate by his colleague, Hon. John C. Spooner. Our members of Congress might be expected to furnish reliable information. They are selected to make laws for the people, theoretically, because each one knows the condition and needs of his constituents, and how to provide for them. But the above assertion has been investigated by the "Journal," with the result of proving, either that a false statement had been willfully made by one of the Senators, and repeated by the other, or that both were ignorant of affairs in the State they represent that any observing man must be aware of. Foreclosures have to be advertised in the local papers, and, out of forty of the "Journal's" exchanges from within the State, foreclosure notices were found in fourteen. In these papers were thirty-two notices. The papers examined are not more than one eighth of those published in the State. The "Journal" also wrote for the records of foreclosures for the last ten years in most of the counties of eastern Wisconsin, as far north as the farming region extends. In reply, letters were received, mostly from county officials, which were published in the "Journal" of February 1st, and which showed that in nine counties of Wisconsin there have been seven hundred and eleven farm-mortgage foreclosures in ten years, involving $1,297,905.49. These counties contain about one sixth of the population of the State, and, allowing liberal margins, the "Journal" estimates that twenty-five hundred farm mortgages have been foreclosed in the whole State during the past ten years. Senator Sawyer resides at Oshkosh, in Winnebago County, which is not one of the nine counties above mentioned, but foreclosures occur in the Senator's immediate vicinity as well as in the rest of the State. The "Journal" quotes the "Oshkosh Times" as saying, "In the year 1888 ten mortgages were foreclosed on farms in Winnebago County, and in 1889 four more changed hands in the same way." And yet Politician Sawyer declared that he had never known of but one foreclosure in his section of the country. It is obviously unsafe to assume that what a politician don't know, therefore, does not exist.

Senator Sawyer's alleged ignorance reminds one of Sam Weller's behavior on the witness-stand in the great Pickwick trial, when his father had been guilty of disturbing the court. On that occasion the judge asked:

"Do you know who that was, sir?"

"I raythor suspect it was my father, my lord," replied Sam.

"Do you see him here now?" said the judge.

"No, I don't, my lord," replied Sam, staring right up into the lantern in the roof of the court.

Senator Sawyer must have been looking hard in some other direction when notices of foreclosures in his section were floating about. Politicians do not deal much in facts. Their stock in trade is mainly exaggerated assertions, off-hand denials, and buncombe, and they trust to their eloquence, their artful ways of putting things, or to the authority of their official positions to secure belief. When it suits their purposes to have the truth known, they bring it out with a grand flourish of figures; but when it seems to them more politic to keep the public in ignorance, they take refuge in general assertions. The true state of affairs in any given case can only be learned by searching out all the separate facts. Just as truly as eternal vigilance is the price of liberty, the price of truth is thorough investigation.

Very truly yours,

FREDERIK A. FERNALD.

NEW YORK, *February* 22, 1890.

RIGIDITY OF THE SUSPENSION BRIDGE.

Editor Popular Science Monthly:

SIR: In the article on "The Evolution of the Modern Railway Bridge," by Prof. Jameson, he says (page 478) that "it" (namely, the cantilever bridge) "can be given great rigidity and stability, which are impossible in the suspension (bridge)," to which should have been added, "as usually built," because otherwise the statement would not be correct.

Prof. Jameson himself correctly states in another place (on page 475) that "a suspension bridge is nothing else than an arch bridge turned upside down." It follows that a suspension bridge can be built just as rigid as an erect arch bridge. But it is demonstrable that a suspension bridge can be made more rigid, particularly against lateral forces, than an erect arch. A suspension arch is in *stable* equilibrium; an erect arch is in *unstable* equilibrium, and requires lateral bracing, which the suspended arch does not require. Thus, if the steel arches of the St. Louis Railway Bridge were turned upside down, with the roadway suspended from them, and if the compression tubes were replaced by steel links, the suspended arches

thus formed would have the same vertical rigidity as the existing compression arches, and it is obvious that the lateral bracing which is necessary for the tubes of the erect arch could be dispensed with for the links of the suspended arch. The question of anchorages is outside of the comparison.

The popular misconception as to suspension bridges is due to the many insufficiently stiffened structures of this kind. No other bridge system can be built so imperfectly stiffened, and yet be safe, as the suspension bridge. An erect arch bridge built in the same manner would fall of its own weight.

Another popular and fashionable conception, but a misconception all the same, is as to the merits of the cantilever bridge. Theoretically and practically, the cantilever of all bridge systems has the greatest deflections and oscillations under passing loads, *all other things being equal*, and therefore is the least rigid system. It has, however, its good uses otherwise. GUSTAV LINDENTHAL.

PITTSBURG, PA., *February* 2, 1890.

THE SALT PRODUCT OF KANSAS.

Editor Popular Science Monthly:

DEAR SIR: In your issue of January, 1890, page 430, under "Notes," it is said, "One hundred and fifty-five barrels of salt were manufactured in Kansas in 1888, and it is estimated that the output in 1889 will be not less than three times as large."

From the annual report of the Secretary of the State Board of Agriculture for 1888, it is learned that seven salt-works reporting produced 122,420 barrels. Of the seven, three reported to December 31st, and four to November 30th. One of the seven reporting began March 15th, three in October, and two in November.

From the same source for 1889, 547,224 barrels of salt were manufactured and 19,056 tons of salt not put in barrels. Seventeen companies reported in the latter year.

I have bought a copy of "The Popular Science Monthly" since its first publication, and I was loath to pass such an error unchallenged. Success to you and yours.

J. G. WOOD.

TOPEKA, KANSAS, *February* 11, 1890.

[The number intended was 155,000 barrels. The dropping out of the thousands in transcribing the item escaped notice. On the basis of that number, the output of Kansas salt in 1889 would be, according to Mr. Hay's estimate, not less than 465,000 barrels. We thank our correspondent for giving us the opportunity of correcting the error.—EDITOR.]

EDITOR'S TABLE.

POLITICAL ECONOMY.

AMONG the regularly constituted sciences that claim the attention of the world to-day, it can scarcely be said that political economy has an undisputed place. Fourteen years ago, in an article on the centenary of the "Wealth of Nations" (which fell in the same year as the centenary of our Declaration of Independence), the late Prof. Jevons acknowledged that there was then far less agreement among teachers of political economy, in regard to the fundamentals of their subject, than there had been fifty years earlier. He acknowledged, also, how little interest was taken in lectures on political economy at the universities, and how little weight was attached by practical men to propositions or principles put forth as the result of studies in that field. How does the matter stand now that fourteen years more have flown? Has the credit of the economists of the generation that has passed away—the Mills, the McCullochs, the Seniors, the Says—been in any degree rehabilitated? Scarcely. As time goes on, it becomes increasingly clear that the whole work of these writers was carried on too much in the region of abstractions, and was too little vivified by direct contact with facts. Bacon long ago remarked on the error of those who supposed in nature a greater simplicity than really exists; and this error was abundantly exemplified by the classical or "orthodox" economists. It was to certain minds, no doubt, a fascinating pursuit to seize upon two or three general principles, and by their help to interpret and methodize all the complex phenomena of economic production, distribution, and exchange; but the process was hazardous in the

extreme, and much that passed for brilliant philosophizing fifty or even thirty years ago is now regarded as little better than obsolete sophistry. Two of the latest works that have fallen into our hands—Mr. Wordsworth Donisthorpe's "Individualism; a System of Politics," and Prof. Thorold Rogers's "Economic Interpretation of History"—illustrate this very strongly. "Practical men," says the former, "have long since ceased to attach any importance to the slipshod twaddle of those who pose as the theorists of the art of wealth-producing." The latter, referring, as it would seem, particularly to Mill, says: "The political economist of the later school has thoroughly carried out in his own person the economical law which he sees to be at the bottom of all industrial progress—that of obtaining the largest possible result at the least possible cost of labor. He has, therefore, rarely been at the trouble of verifying his conclusions by the evidence of facts. He has, therefore, constantly exalted into the domain of natural law what is, after all, and at the best, a very dubious tendency, and may be a perfectly baseless hypothesis. His conclusions have been rejected by workmen and flouted by statesmen."

We quote these passages not as fully indorsing them, but simply as showing to what extent the authority of a school that once was dominant is to-day called in question, if not discredited. At the same time, we fully believe that, before political economy can be a science in any satisfactory sense of the term, it has to be reconstructed and rewritten in the light of careful inductions from vast collections of facts. The basis of the "orthodox" economy was too narrow, while its method was too deductive and dogmatic. Mr. Mill was a man of a mind at once acute and candid; but he had not received the education that fitted him for the vast task which he assumed of reviewing the whole field of economics and enlarging its boundaries. In his youth he was overdrilled by a stern and remorselessly logical father. His attention was largely turned to classical, historical, and mathematical studies. In the region of natural science he never acquired any real competency. His tendency was, therefore, rather to read theories into facts than to make facts point the way to theories. His mind was extremely hospitable to new ideas, and his sympathies were quick and warm; upon the whole, few truer or better men have ever lived; but he had only a kind of literary acquaintance with economic facts, and it is not surprising that much of the reasoning in which he indulged is now seen to have been concerned rather with fanciful abstractions than with real things.

The political economy of the future will be of comparatively slow growth, but it will deal with men as creatures of flesh and blood; not as automata moved by a few ticketed wires. The materials for the rising science are being laboriously gathered by many earnest investigators, who are fully alive to the errors of their predecessors, and who mean, therefore, to let the facts as much as possible speak for themselves. To the new political economy many independent lines of inquiry will contribute. The biologist, the moralist, the statesman, the lawyer, will all bring their stores of carefully assorted data; and, when these have been further arranged and correlated by minds of competent scope and grasp, we shall begin to see the outlines of a much more comprehensive theory of economics than any that has heretofore been given to the world. In a word, science will undertake to organize a region that in the past has been too much given over to *a priori* speculation, with its natural accompaniment of presumptuous dogmatism. In future our concern will be not with the *opinions* of individual writers, but with their *demonstrations;* mere hypotheses will carry no more weight in

this field than in any recognized department of natural science. What the effect upon social order and progress of a really well-constituted science of political economy will be it is not difficult to foresee. It will act as the great harmonizer of conflicting claims, and a most potent aid to the realization of justice in all human relations. And once more it will be proved that the only way to know things is to know them practically, and that the only way to build up a science is to bring the facts together, and *all* the facts.

EXAMPLE IN MORAL TEACHING.

Our correspondent, who writes on "Moral Instruction in our Public Schools," in this number of the "Monthly," points out an influence that profoundly affects the education of American youth. What Mr. Meredith states in modern scientific language—that man is an imitative creature—had been learned generations ago from the experience of practical men, and applied to education in the terse maxim, "Example is better than precept." Who that has had the care of children does not know how readily they do what they have seen older children and grown people do, and how hard it is to make them remember what they are told to do! This should be a sufficient reason to make every person so order his daily life that it shall be an improving object-lesson to his own children and to the children who are to be the associates of his own. It should be a sufficient reason, also, as our correspondent points out, for elevating only men of high integrity to positions of trust and power. In a country where it is possible for any native-born boy to become the head of the nation, youthful ambition has free scope. In order to satisfy this desire, the means by which public officials have risen to power are copied, the traits of successful men are imitated, even the manners and habits of those whom the people honor are adopted by the young. Hence it is extremely important that these means and traits and habits should be worthy of imitation. A determined effort should be made to check the demoralizing influence at present exerted by American public life. If this is not done speedily, the evil will grow as slavery grew, till it finally challenges the nation to a life-and-death struggle whose outcome no one can foresee. The example set by the present generation will determine whether the children now growing up shall be arrayed on the side of virtue and honor, or shall swell the ranks of corruption and crime.

We emphatically dissent, however, from Mr. Meredith's proposition that all is being done in the public schools that can be done, in the line of moral instruction. There is probably not a city or town in the country where morality is a recognized subject of instruction in the common schools, standing on the same footing as spelling or geography. Our schools give only information that will serve business purposes or discipline the mind, and utterly neglect training in right conduct. Their aim is to turn out money-getters, rather than to produce good citizens. If our schools were to give as much attention to judicious instruction in ethics as they now devote to the teaching of arithmetic, for instance, we believe that they would come much nearer to exerting the beneficial influence that is claimed for them than they do at present.

AN UNFOUNDED STATEMENT.

The "Chautauquan" is a magazine published for the benefit of what is known as the "Chautauqua Literary and Scientific Circle." It is religious in its general character. It contains "Sunday Readings" which are noted as "selected by Bishop Vincent." In one of these we lately read the following: "Some counselors, like Herbert Spencer, advise us to follow our own self-interest, without concern for others, with the assurance that all will be thus happier, be-

cause more independent." Now, why a statement like this, which is absolutely without foundation and entirely misleading, should be considered as particularly suitable for Sunday reading, we, who are not of the "Circle," can not in the least divine. It is given to the members of the Circle, however, as the utterance of a leading educator, Dr. Hill, President of the Baptist University of Rochester, and with the indorsement of Bishop Vincent, who, by selecting it, stamped it with his approval. The ordinary members of the Circle will, therefore, feel justified in accepting it without hesitation or reserve, and will form their opinion of Herbert Spencer accordingly. The wrong is done, not so much to Mr. Spencer, whose reputation is established in the world of philosophy and science, as to the members of the Circle, who are made to receive a false impression of his moral teaching. If Bishop Vincent is not too busy with work of more importance, we would earnestly invite him to do one of two things—either justify the above statement in regard to Mr. Spencer or withdraw it, and that in the same columns in which the statement appeared. We affirm most emphatically that it does entire injustice to Mr. Spencer's teaching.

LITERARY NOTICES.

PHYSIOLOGY OF BODILY EXERCISE. By FERNAND LAGRANGE, M. D. The International Scientific Series, Vol. LXVI. New York: D. Appleton & Co. Pp. 395. Price, $1.75.

IN early times men depended upon the constant use of their physical strength to obtain the means of subsistence, and to protect themselves and their possessions against violence; during a later period, when a class had arisen whose subsistence was provided by serfs, even these were still required by custom to use their muscles in warlike exercises; at present a large and increasing portion of civilized men are engaged in occupations which do not demand bodily exertion, and much of the labor formerly done by human muscles is now performed by steam and electricity. The modern man has reveled for a time in bodily inactivity, but is now waking up to the fact that exercise is as essential to health and the enjoyment of life as sufficient food and sleep. But there are many who have not yet learned this lesson, and not all of those who are willing to take exercise have the right knowledge to secure for them its full benefits, or to protect them against its misuse. Knowledge of this sort it is the object of the present volume to supply. We do not know of any other book that explains so fully as this what goes on within the body when the muscles are used. The author first describes the process of muscular work, then explains the nature of fatigue, tells what changes in the body are produced by habituation to work, what the essential characters of the different exercises are, what results are effected by different kinds of exercise, and closes by pointing out the office of the brain in exercise. The slightest movement performed by the human machine, he says, brings into play the neighboring parts, and sometimes also more distant ones. The old soldier who said, "When I had my two legs, I used to give a splendid blow with my fist," spoke sound science. Hence an exercise may produce marked effects in a part of the body where we should not have dreamed of looking for them. The great organic functions of the body are not isolated from the work of the muscles. More blood is drawn to the working muscular masses, and this stimulus to the circulation causes the lungs to draw in a larger supply of air. It is commonly said that work produces heat in the body, but in reality the heat is the cause of the work, and is itself produced by combustion of the nutritive substances derived from our food, of the fat, and, when these are exhausted, of the bodily tissues. The waste products of this combustion clog the muscles and are one of the causes of fatigue. Breathlessness is caused by violent exercise, which suddenly increases the quantity of carbon dioxide in the blood, and makes a great demand on the lungs to eliminate the poison. The stiffness of fatigued muscles is due to other waste products, notably the urates. Overwork causes more of such products to be produced than can be excreted; hence they accumulate within the

system, and their poisonous action often brings on a fever similar to typhoid. The organism is poisoned by its own products. Repose brings cessation of painful frictions of nerve-fibers and shocks of muscle-fibers, and allows time for the elimination of waste products and the repair of the tissues. The construction and action of the bodily organs become so modified by training that they can do more work without fatigue than before. Dr. Lagrange classifies exercises as those of strength, of speed, and of endurance. Before passing to the general effects of exercise, he tells what groups of muscles are brought into action in the common exercises. Exercise produces salutary effects, he says, alike in those who assimilate too little and in those who do not dissimilate enough. The enlargement of the chest cavity is one of the most beneficial results of exercise, and many suppose that it can be best secured by the use of the arms, but Dr. Lagrange argues that exercises of the legs are most effective in expanding the lungs, because the legs can do more work than the arms, and thus create a greater respiratory need. The author then points out how some popular exercises cause deformity, and names others which do not have this tendency. It has been found that brain-work, like muscular exertion, is attended by a greater flow of blood to the working organ, an increase of heat, more vigorous combustion, and hence increased formation of waste materials. Mental overwork, also, leads to feverish states, which must be attributed to the accumulation of products of combustion, as in the case of physical overwork. Now, while the muscles are the immediate agents in bodily movements, the exciting cause of the movements is the will. In executing a difficult feat much brain-work is demanded in order to co-ordinate the muscles employed, and, if the brain is already overworked, the author concludes, such an additional mental task is injurious. Hence, for persons suffering from mental overwork, exercises which can be performed automatically should be prescribed, rather than exercises of skill. The volume furnishes practical information which will enable the reader to so regulate the amount and kind of his exercise as to benefit and not injure himself. Its style is simple, and the reader is led along by such easy steps that the course of the exposition can be readily followed. This latest addition to the International Scientific Series ranks with the best of its companions in importance and general interest.

THE CONTINUOUS CREATION. AN APPLICATION OF THE EVOLUTIONARY PHILOSOPHY TO THE CHRISTIAN RELIGION. By MUYRON ADAMS. Boston and New York: Houghton, Mifflin & Co. Pp. 259. Price, $1.50.

THE author of this work, who is pastor of a Congregational church in Rochester, N. Y., believes that the "inevitable revolution which Matthew Arnold declares is befalling the religion in which we have been brought up, is part of that evolution by which God continues the higher processes of creation." He conceives the possibility of thinking under the principle of evolution and at the same time as a Christian believer, and believes that before long it will be found impossible to think clearly in any other way. The book is the outcome of a course of Sunday evening lectures which he delivered to his congregation on evolution and its relation to religion. A key to the central thought of the work may be found in a comparison, in the second chapter, between the former and more recent theories of creation. "According to the old story of creation, which was based upon no facts, but only upon a misinterpretation of revelation, God made man at one stroke, not as a sculptor makes a statue, not as an inventor makes a machine, but as the magician makes his prodigy. Accordingly, God is no constant and necessary factor of creation, but is a being who may be dispensed with, except for occasional irruptions into our region of space to perform wonders. Now, in place of such a conception, evolution offers a far nobler one; and produces an array of facts, ever increasing in bulk and significance, to substantiate it. The process of change which goes on generation after generation, and age upon age, is creation. The Creator does not act as a magician, suddenly, as by mere impulse, but as the steady, eternal energy, and ever according to that purpose which we begin to consider." Again, in the chapter on "The Idea of God": "When we are told that evolution abolishes God, or renders him superfluous, we see, on the con-

trary, that evolution can not proceed one step without God. The materialist may declare that evolution proceeds by material energy or force. The agnostic may say that we do not know and can not know. The theist identifies the universal Power and Intelligence, proceeding by universal laws, as the Being of whom men have had imperfect intuitions, of whom men have had inspirations." As to the bearing of evolution on religion, we are told: "There is a feeling that evolution is dangerous. The exaggeration of that feeling is that evolutionary philosophy comes as a whirlwind to destroy religion; on the contrary, it comes to restore and revive it. My friends, evolution will prove itself dangerous to the kind of religion which treats it in that way. The religion that seeks to stand on the ground of opposition to light, on the ground of resistance, will find itself more and more threatened and undermined by it." The evolution of the idea of immortality is also regarded as of the highest importance, as showing the consummation of the works of creation. Other special topics considered include the Bible as a record of religious gradual growth, "the problem of evil," the relations of evolution with Christianity and with special features and aspects of Christian faith, and its relations with social institutions and development. Finally, criticism, both higher and lower, and that of all shades and grades between, is declared really to have but the one purpose of coming at the abiding and the useful. The law of development being all-inclusive, "truth, sacred truth, must also have its course of development and progress. It can not long be contained in any statement or mass of statements. It increases by its own vitality and outgrows the most elaborate and finished form in which any age can put it. And, above all, religious truth is not stationary—a jewel cut and fashioned by skillful device; it is in the nature of seed, inclosing the elements of growth, else it is no vital truth. . . . The serious concern of all men ought to be to know the truth, and to commit themselves to it. Not to commit themselves to the uncertainties, but to the certainties. So far as they do that, they will have no fear of the thrashing process of criticism which comes at various periods, and has now come."

EPITOME OF THE SYNTHETIC PHILOSOPHY. By F. HOWARD COLLINS, with a Preface by Herbert Spencer. New York: D. Appleton & Co. Pp. 571. Price, $2.50.

WE have here an eminently useful idea carried out in a very satisfactory manner. Mr. Collins has undertaken the by no means inconsiderable labor of going over the ten published volumes of Mr. Spencer's system of philosophy and summarizing them page by page. As he states in the "Compiler's Preface," "The object of this volume is to give in a condensed form the general principles of Mr. Herbert Spencer's philosophy as far as possible in his original words. In order to carry out this intention, each section (§) has been reduced, with but few exceptions, to one tenth; the five thousand and more pages of the original being thus represented by a little over five hundred. The 'Epitome' consequently represents 'The Synthetic Philosophy' as it would be seen through a diminishing glass; the original proportion holding between all its varied parts." Mr. Collins has aimed to present every salient point, to omit no essential link in the argument by which the celebrated exponent of the doctrine of Evolution deduces the whole course of history and the laws that govern all nature, animate and inanimate, from certain fundamental postulates of the most abstract or at least of the most general kind. The first thing that strikes us is the severity of the test to which Mr. Spencer's philosophy has thus been subjected. Stripping off all externals and non-essentials, Mr. Collins has laid bare the very framework of the system. He has reduced the Synthetic Philosophy to a series of almost naked propositions, the connection or lack of connection of each of which with those that precede and follow can be seen at a glance. Opinions will doubtless differ as to the degree of logical coherence thus brought to light; but we must declare, for our own part, that we are impressed anew, not only with the wonderful grasp of Mr. Spencer's mind, but with the philosophic unity of his thought. The apostle of Evolution has afforded us, in his successive volumes and in the successive chapters of each volume, one of the most magnificent examples of evolution. The success with which he has developed his system speaks power-

fully for its essential conformity with the true order of nature.

It is hard to say whether Mr. Collins has rendered a greater service to those who are already familiar with Mr. Spencer's writings or to those who will first obtain some knowledge of them through his book. Certainly the former will thank him warmly for having placed within their reach a compend which will enable them at any moment to study to the greatest advantage the connection of the different parts of Mr. Spencer's system, and to refer at once to any portion which requires for its full comprehension that more complete elucidation which Mr. Spencer's own works supply. In the preface he has written for the present work Mr. Spencer says that he was somewhat surprised to find that it had been possible "to put so much into so small a space without sacrifice of intelligibility." We are not surprised at his surprise. The result must be attributed to Mr. Collins's skill; but it also testifies to the essential lucidity of the text on which Mr. Collins was working. With the utmost skill he could not have made pages intelligible that were involved in obscurity and self-contradiction. No one who is really interested in Mr. Spencer's writings will care to be without the present manual. Giving, as it does, the gist of every paragraph in the original volumes, it will in many cases render the consultation of those volumes unnecessary. What Mr. Spencer thinks is here, we might almost say, fully set forth. His own books give us in addition confirmatory reasonings and illustrations. Any one, therefore, who, without knowing anything of Spencer, becomes interested in Mr. Collins's epitome will probably seek the fountain-head whence so much of striking thought and compact argument has been derived.

Naturally, certain parts of the present epitome are more effective than others. The section on the Unknowable in Mr. Spencer's "First Principles" does not admit of much condensation, and here the epitome is too abstract for anything like general reading, though possessing in common with all the rest a high degree of usefulness for serious students of Spencer. The same remark applies to large portions of the "Psychology;" but in the biological and sociological portions Mr. Collins has given us a version of Spencer that is at once pithy, vigorous, and thoroughly interesting. We could quote scores of paragraphs that tell their tale with admirable condensation and point, and that make good reading for any day in the year. The effect, therefore, of the present work, we may hope, will be to popularize to some extent a system of thought which, abstract as it may seem, has been elaborated by its distinguished author in the most practical spirit possible and which can not become more widely known without conferring proportionate benefit upon society.

SPECIAL PHYSIOLOGY, INCLUDING NUTRITION, INNERVATION, AND REPRODUCTION. By JOHN GRAY M'KENDRICK, M. D., LL. D., F. R. S., Professor of the Institutes of Medicine in the University of Glasgow, Fellow of the Royal College of Physicians of Edinburgh. London and New York: Macmillan & Co. 1889. 8vo. Pp. 803. Price, $6.

DR. M'KENDRICK states in his preface that it has been his "endeavor throughout this volume to lay before the reader the main facts of physiological science, and as far as possible to state these facts in terms of measurement. The time has gone past for vague generalities in the description of physiological phenomena, and physiology is year by year drawing nearer to her true position as a science, dealing as strictly with the phenomena and basis of organic life as physics deals with those of dead matter."

The book is divided into sections, subdivided into chapters. The sections deal, in order, with nutrition; food; digestion; absorption; the blood and its circulation; respiration; assimilation or nutrition; glycogenesis; excretion; the income and expenditure of the body; animal heat; the nervous system; the senses; the voice; animal locomotion; and reproduction. There are four hundred and eighty-five illustrations.

Dr. M'Kendrick's well-known scholarship is a guarantee that this book is a valuable one. But that such is the fact would be quite apparent from inspection, even were his name not placed on the title-page. It gives the latest results of physiological study with accuracy and exactness. Whether or not his expectations, quoted from the preface, are ever to be realized, he certainly has aided to advance the science of physiol-

ogy in the direction of his ideal. While the difficulties in the way of quantitative estimates of physiological phenomena are sometimes very great, that is no reason for relaxing efforts to overcome them, since in the accomplishment of this lies the hope of perfecting the science.

We have little space for special criticisms, but we think the author would have done better to leave some things to psychology, which he includes in his work. For instance (page 658), he speaks of *pain* as "a third kind of sensation, unlike touch and temperature." Now, there is a long-standing controversy as to this point—whether pleasure and pain are distinct sensations or a quality of all sensations. Dr. M'Kendrick ought to have seen that this question could not be disposed of in a paragraph. Moreover, he should have recognized that it is clearly and peculiarly a psychological question. To include such a statement as he makes in a physiological work is certainly an error, whether he be right or wrong. And the assumption he makes is, besides, one which he would have great difficulty in substantiating. The likelihood is that pleasure and pain are not distinct forms of sensation, but qualities of all sensation whatsoever.

PROBLEMS IN AMERICAN SOCIETY. By JOSEPH H. CROOKER. Boston: George H. Ellis. Pp. 293. Price, $1.25.

SIX essays on moral and social problems of the time constitute this volume. The first is entitled "The Student in American Life," and its key-note is contained in the words "Americans are prone to ignore the vast practical importance of cultivated men." The second essay gives a sketch of the history of scientific charity, from the "Hamburg System" to the "Charity Organization" system of England and America, embodying many of the principles of this method of diminishing poverty. "The Root of the Temperance Problem" is the subject of the next paper. The author does not think attacking the saloon-keeper is the way to reach the root of drunkenness. On the contrary, "true temperance methods," he says, "are such as reach the reason, the conscience, and the will of each individual." There is an essay on "The Political Conscience," which in many men is a coarser article than the private conscience. In regard to "Moral and Religious Instruction in our Public Schools," the author maintains that, "logically there is no stopping short of a state religion, if religious instruction is insisted upon in the public schools"; and in answer to the question, "Shall, then, our public schools *teach* a formal moral code?" he answers: "No; rather let them possess a moral atmosphere, derived from the personality of the teacher." In the closing essay he discusses the fact that many villages having churches of half a dozen sects are almost destitute of real religion.

THE TOWN-DWELLER: HIS NEEDS AND HIS WANTS. By J. MILNER FOTHERGILL, M. D. With an Introduction by B. W. RICHARDSON, M. D., F. R. S. New York: D. Appleton & Co. Pp. 118. Price, $1.

Two general reasons are given by Dr. Fothergill for the dwellers in towns being inferior physically to the inhabitants of the country. First, a natural selection draws the slight men of active brain from the country into the towns; and, second, the conditions of life in the towns are hostile to physical vigor. In successive chapters of this book the dangers in these conditions of city life are pointed out. The house of the town-dweller may be built on a rubbish-heap, and have smoky chimneys and dangerous plumbing. His surroundings may include noisy or ill-smelling premises, while street noises afflict the best city neighborhoods. The air he breathes lacks ozone, and is charged with the oxides of carbon, sulphur dioxide, and metallic fumes, and contains often irritating dust. The water-supply of towns is not always wholesome. The town-dweller eats too much meat and white bread, and he rejects fat, which shows that his digestive organs are too weak to digest it. Too much tea and alcoholic beverages are consumed by town-dwellers, and the liquors often contain substances more harmful than alcohol. Most of the work of the town is done indoors, and in a hot atmosphere, which favors the handling of small objects. Town amusements are also mostly carried on indoors, and furnish little of the recreation needed. The brain and nerves of the town-dweller are unnaturally developed, while his muscles and internal organs are proportionately weakened. Bright's disease and dia-

betes are especially associated with the mental activity of town-dwellers. Their children are sickly, and if it were not for the constant inflow of new blood from the country, the towns would be depopulated in three or four generations. Dr. Richardson, in his introduction to the volume, says, "The divisions are excellent, the title of each division attractive, and the mode of progress from stage to stage artistic." He draws attention to certain "short, sharp sayings, each one in its proper place, and easily learned and not easily forgotten." As samples of these he quotes, "Flags and pavements produce no grass." "Brains are the finest raw material of a country." "To kill the weak and injure the middling is a long price for education." He calls it also an eminently suggestive book, which, if the author had lived, would doubtless have been expanded.

ON THE CREATION AND PHYSICAL STRUCTURE OF THE EARTH. By JOHN T. HARRISON. London and New York: Longmans, Green & Co. Pp. 189. Price, $2.50.

THE author offers this production as an essay toward a theory of the formation of the earth's crust. In his discussion he makes liberal use of passages in the writings of the leading geologists, which often reveal wide differences of opinion concerning the questions discussed. He also puts at the heads of several chapters, and scatters through his text, passages from the Bible, with which he evidently deems it essential that his views should conform. A striking case of this tendency to subordinate his opinions to the imagined geological teachings of the Bible is where he says that the earthquakes which now occur result from disturbance of the crust in one or other of the old lines of rupture, and asks, "Who can earnestly consider this condition of the earth and say that it may not be nearly ripe for another paroxysm?" He then quotes from Prof. Hitchcock to the effect that the earth contains within itself chemical energies sufficient to accomplish its own destruction, and adds, "We have the yet older and surer revelation that the earth shall reel to and fro like a drunken man, and, when enveloped in flames, all the works of man shall be burned up." This, in spite of the fact that the progressive cooling of the earth points to its end in frigidity.

A TEXT-BOOK OF ANIMAL PHYSIOLOGY, WITH INTRODUCTORY CHAPTERS ON GENERAL BIOLOGY AND A FULL TREATMENT OF REPRODUCTION. For Students of Human and Comparative (Veterinary) Medicine and of General Biology. By WESLEY MILLS, Professor of Physiology in McGill University and the Veterinary College, Montreal. New York: D. Appleton & Co. 1889. 8vo. Pp. 700.

THE plan of this important work is new. It adopts the comparative method, begins with general biology, treats of the cell as the unit, gives an account of unicellular vegetal organisms both on the morphological and the physiological side, then of unicellular animals, next of multicellular organisms, leading up to a consideration of the animal body, the animal kingdom and man's place therein. Following all this is a full exposition of the origin of life in general and of reproduction, very admirably presented. Then the chemical constitution of the animal body is taken up, the blood and the contractile tissues are examined, the graphic method is extensively applied to the study of muscle physiology, the circulatory system is explained, succeeded by an account of the digestive system. Excretion is next dealt with, then the metabolic or chemically transforming processes, while the nervous system and the senses form the concluding portions of the work.

The plan has obvious advantages. It is much better adapted to giving the learner a correct and comprehensive view of physiology than treatises in the usual form and order. Moreover, the work in question is admirably executed and has all the characteristics of a truly scientific production. It is certain that physiology must be hereafter studied with reference to general biological laws, and not by piecemeal methods. Then books like the present one will inevitably supersede the older text-books, presenting a less unified physiology. Dr. Mills's volume will help this progress. It may be safely recommended as one of the best treatises on the subject extant, and in respect to method we know of none more praiseworthy.

LA PISCICULTURE EN EAUX DOUCES (Fish Culture in Fresh Waters). By A. GOBIN. Paris: J. B. Baillière et Fils. Pp. 360.

M. GOBIN has given us a handy and useful book, comprehensive and practical. The

subject has been introduced into the agricultural and national schools of France, and the art has become there, according to the author, not only a regular branch of industry, but also the fashion. It is recommended as being equally well adapted to women with the care of poultry, bees, and silk-worms. "As a recreation, it interests the mind and the eyes; and it has been well tested as an economical resource. As a regular pursuit, it has been taken up and then dropped several times; in the present effort that is making to establish it on a systematic basis, the United States is acknowledged to be in advance of any of the European countries which are named. Of its importance, the author well says that, in a period of civilization like that which we have reached, every waterfall, however slight it may be, should and can be utilized as a motor force, and every stream and water surface should be made to support the maximum of aquatic inhabitants best suited to purposes of food. To obtain this condition, nothing has to be created. All that is necessary is "to study and adopt what has been done in England, Switzerland, some places in Germany, and especially in the United States." In the several chapters and sections of the book are considered the properties of fresh water, the different kinds of fish, natural and artificial breeding and feeding, the construction and management of fish-ponds, the management of lakes and methods of dealing with running waters, migratory and "sedentary" fish, crustaceans, lagoon fish, and sea fish. The whole is abundantly and satisfactorily illustrated, and a classified list of the fresh-water fishes of France is added.

A paper that will have value for manufacturers of iron and steel is that on *The Construction of Cupolas for the Melting of Pig-Iron*, by *M. A. Gouvy, Jr.*, translated by *W. F. Durfee*, which appeared in the "Journal of the Franklin Institute" for January, 1889. It presents, in one comprehensive view, most of the experiments that have been tried in many lands, with a hope of improving the working of cupolas; and the translator believes that, if its conclusions are intelligently followed by users of cupolas, very large economies of fuel will result. Among the experiments whose history is given in this sketch are the employment of hot blast, utilization of the gas escaping from the top of the furnace, changes in the form of the vertical section of cupolas, cooling the walls, equal distribution of the blast, suction-blast, gas-firing, and complete combustion of the carbonic oxide. The author points out clearly the advantages and disadvantages of each of these devices, and at the end sums up his conclusions. A table giving the relative dimensions, the product, and the consumption of fuel in thirty-three cupolas of various construction accompanies the paper.

The purpose of the manual on *Foods for the Fat*, by *Nathaniel E. Davies* (Lippincott, 75 cents), is to enable persons suffering from corpulency to so regulate their diet as to cure their ailment. The first division of the volume tells the amount of food required by persons in ordinary occupations, the uses of fat in the body, and the effect on corpulency of exercise, stimulants, tea, coffee, and other beverages. In the second part of the book a list of articles which may be eaten by the corpulent is given for each month, and something more than half the volume is devoted to recipes for preparing such articles.

Dr. *George M. Gould*, of Philadelphia, publishes a report of three cases in which, respectively, chorea, flatulent dyspepsia, and palpitation of the heart had been caused by eye-strain, and were cured when the eye was relieved. Following the line of research thus opened, the author examines the relation of sexualism and reflex ocular neuroses, and finds a means of accounting for the headaches of women in the years between puberty and middle age, and for various other functional derangements.

The object of the *Inventor's Manual* (J. F. Davidson & Co., New York, $1) is "to give the inventor and patentee some hints on patents generally, together with information on ways of exhibiting inventions, bringing them to public notice, and effecting sales." Among the subjects treated in this work are, how to invent, how to secure a good patent, value of a good invention, how to exhibit an invention, how to interest capital, how to estimate the value of a patent, advice on selling patents, advice on the formation of stock companies, forms for assignments, licenses, and contracts, State laws concerning

patent-rights, and other items of information not generally accessible to the inventor or manufacturer.

The following five books and pamphlets are issued by the Woman's Temperance Publication Association: *The Year's Bright Chain* (price, 50 cents) consists of twelve pages of quotations from the writings of *Frances E. Willard*, alternating with full-page pictures representing the months. Each picture is accompanied by a couple of stanzas of verse telling the wish the month grants to a boy and to a girl. A finely engraved steel portrait of Miss Willard forms the frontispiece. The artistic and mechanical quality of the book can not fail to delight her young admirers. *Frances Raymond's Investment*, by Mrs. *S. M. I. Henry* (price, 50 cents), is the story of a woman's complaint against the State for the loss, due to the licensed saloon, of what her boy had cost her. *The Unanswered Prayer; or, Why do so many Children of the Church go to Ruin?* also by Mrs. *Henry* (price, 50 cents) consists of several chapters of counsel to mothers in regard to saving their children from the evils and dangers that beset them. *Songs of the Young Woman's Christian Temperance Union*, by *Anna A. Gordon* (price, 25 cents), consists of ninety-five pages of words and music, suitable for temperance meetings. *Crusader Programs* (price, 25 cents) is a collection of exercises, consisting of recitations, dialogues, etc., interspersed with songs, and designed for the Loyal Temperance Legion, Sunday schools, etc., and adapted to Arbor-day, Easter, Decoration-day, and other occasions.

A new review, called *The Arena*, has been started in Boston, under the editorship of *B. O. Flower* (The Arena Publishing Company, $5 a year). The promise that it will be "a field of combat" where the many social, ethical, and political questions of the day will be fought over, seems likely to be verified, for among the contributors to the first two numbers are some of the most belligerent writers for the press who are now in the field. These are such as Robert G. Ingersoll, who opens the first number with an article on "God in the Constitution"; Lawrence Grönlund, who writes on "Nationalism"; Hugh O. Pentecost, on "The Crime of Capital Punishment"; Henry George, on the "Rum Power"; Rev. Minot J. Savage, W. H. H. Murray, Mrs. Mary A. Livermore, and Hudson Tuttle. Besides these serious discussions, *The Arena* offers papers on literary subjects, by Dion Boucicault, Louis Frechette, and others, and poetry and fiction by Joaquin Miller, W. H. H. Murray, Edgar Fawcett, and others. Each number is to have a portrait as a frontispiece; that of Dion Boucicault appears in the first number, and that of Rev. Minot J. Savage in the second.

In *Some Social and Economic Paradoxes*—a reprint from the "American Anthropologist"—Mr. *Lester F. Ward* sustains a number of theses, the contrary of which is now more currently held, such as that "The artificial is superior to the natural;" "Social activities may be artificially regulated to the advantage of society"; "Reforms are chiefly advocated by those who have no personal interest in them"; "Discontent increase with the improvement of the social condition"; "The means of subsistence increases more rapidly than population," and others on the relations of capital, profits, and wages.

A pamphlet published by E. Truelove, of London—*Home Rule and Federation* is its name, and *A Doctor of Medicine* its author—advocates the federation of nations on a plan resembling that of the United States as the cure or most effective palliative for existing social and political evils. It might begin with states already showing inclinations in that direction, like those of the Balkan Peninsula and Scandinavia; then bring in France and England, whereby, it is suggested, a solution of the Irish question may be found; and at last be made universal.

Some years ago Mr. *J. C. Pilling* undertook the compilation of a bibliography of North American languages; visited many public and private libraries, and corresponded extensively; and embodied the results of his researches in a volume of which a limited number of copies were printed and distributed. He has since continued his investigations, and has collected enough new material to lead to the belief that a fairly complete catalogue of the works relating to each of the more important linguistic stocks of North America may be prepared. Four

catalogues of the new series have been published by the Bureau of Ethnology. The first of them is the *Bibliography* of the Eskimo language, which is spoken by a people covering a very extensive range of territory and widely scattered, and is represented in many dialects. The earliest date recorded in the bibliography is 1729, and it is brought down to include titles that came in while the work was in process of typesetting. Next in order is the *Bibliography of the Siouan Languages*, in preparing which the compiler enjoyed the advantage of the fact that many of those who have fashioned the literature of the language are still living, and he has had personal intercourse or correspondence with a number of them for several years. The publications of the Siouan group cover, perhaps, a wider range than those of any other linguistic group of North America. Nearly every dialect is represented in print or manuscript, either by dictionaries or extensive vocabularies, and pretentious grammars have been prepared of at least five of the languages. The third bibliography is of the *Iroquoian Languages* to which group, perhaps, belongs the honor of being the first of American languages to be placed upon record. The languages most largely represented are the Mohawk and Cherokee. Of manuscripts, mention is made of a greater number in Mohawk than in any of the other languages. Grammars have been printed of the Cherokee, Huron, and Mohawk; dictionaries in Huron, Mohawk, and Onondaga, and, in manuscript, of Seneca and Tuscarora. The *Muskhogean Languages*, to which the fourth bibliographical paper is devoted, are represented by 521 entries, of which 467 relate to printed books and articles and 54 to manuscripts.

Les Trois Mousquetaires—The Three Musketeers—of Alexandre Dumas is published by Ginn & Co., in an edition prepared for the use of schools, by Prof. *F. C. Sunichrast*, of Harvard College. This is one of the best works of the lively novelist, and belongs to a series to which Mr. George Saintsbury has ascribed remarkable and almost unique merits. But all of Dumas's works are liable to objection because of their containing passages unfit to be put into the hands of pupils. The present edition is an attempt to offer a condensation of the book, in which, while leaving the main features of the story and the brilliant and delightful passages untouched, all that is objectionable is excluded, and the volume is brought within such limits of length that it may be conveniently used as a text-book. The notes include explanations of difficult passages and allusions, and notices of historical persons and places mentioned in the story. Price, 80 cents.

The Young Folks' Library, edited by *Larkin Dunton*, LL. D. (Silver, Burdett & Co.), is a series of supplementary readers, designed to give, besides practice in reading, useful information in special lines of school study, and selections from the best literature. *The World and its People* is a section of this library devoted to geography. Book I, *First Lessons*, starts with the building of a doll's house with blocks, and proceeds to the drawing of a plan of a school-room and play-ground, a village, and a city, after which the meaning and use of a map and of the points of the compass are fully explained. Spelling lists follow each lesson, and the volume is illustrated. Book II, *Glimpses of the World*, aims to present such ideas of persons and places as will interest children and fit them for the study of geography proper. The maps inserted usually represent portions of the United States, and at the same time illustrate general geographical features of the world. The frontispiece is liable to give children a wrong idea of the size of the earth; it represents the globe floating in space, with a swallow the size of Greenland flying over it about a thousand miles above the atmosphere. Many poetical pieces are introduced into each book. Other volumes are to follow.

Prof. *Alexander M. Bell* has embodied his widely known system of sound notation in a *Popular Manual of Vocal Physiology and Visible Speech* (E. S. Werner, New York, 50 cents), designed as a text-book for teaching these subjects in schools and colleges. It gives a complete view of the actions of the vocal organs and the resulting elements of speech. The symbols used to represent the various motions and positions of the organs constitute visible speech. The mastery of spoken languages, the exact acquirement of native or foreign pronunciations, the correction of defects of utterance, and

the teaching of articulation to the deaf, are uses to which Prof. Bell's system is applicable.

References to the United States Constitution, by *William E. Foster*, is published as No. XXIX in the series issued by the Society for Political Education, 330 Pearl Street, New York. Mr. Foster, Librarian of the Providence Public Library, is one of the scholarly men who seek to make the collections of books committed to their care of the largest possible public benefit. This pamphlet is an object-lesson in reading with a purpose. It gives clear references by chapter and page to everything in print having a bearing on the Constitution of the United States. We are given a list of the works showing the antecedent influences in antiquity, in German and English institutions, and in American colonial history. The more immediate causes are traced in the records of the Annapolis Convention, 1786, and the Philadelphia Convention, 1787. Next Mr. Foster analyzes the Constitution as framed and adopted, and shows the various sources of its articles. He then proceeds with Constitutional History since 1789, giving reference to all the leading expositions and commentaries on the Federal and State Governments, with notes on the various amendments, and on the comparisons of other governments with that of the United States. An appendix summarizes the decisions of the Supreme Court since 1865 on questions affecting national or State supremacy. Mr. Foster has performed his task with conscientious care and thoroughness. His *References* will save every student of the Constitution much unnecessary labor and bring before him much that he might never otherwise know. (Price, 25 cents.)

Prof. *Simon N. Patten*, of the University of Pennsylvania, in his pamphlet on *The Rational Principles of Taxation*, makes a debatable contribution to a difficult theme. He maintains that the wastes and burdens of competition in methods of distribution are increasing; the great cost of solicitation and advertisement in their manifold forms he holds to be the chief reason why science applied to industry has not enriched the nation as it should. His remedy for undue and wasteful competition is of a heroic kind; it is no other than an adaptation of the high-license plan in dealing with the retail liquor trade. Prof. Patten holds that while that plan deprives no patron of his desired beverages, effects no increase of prices, it results in notable economy to the community in extinguishing one half or more of the saloons, with their outlays for rent, attendants, and so on. He argues that a similar reduction of the ranks of all distributive classes by a high special tax would inure to a general promotion of prosperity in which these classes would perforce share.

PUBLICATIONS RECEIVED.

Appleton, John Howard. Laboratory Year-Book, 1890. Providence, R. I.: Gordon Roscoe & Co. Pp. 31. 12 cents.

Arey, Albert L. Laboratory Manual of Experimental Physics. Syracuse, N. Y.: C. W. Bardeen. Pp. 200. 75 cents.

Astronomical Observatory of Harvard College. Annals.—Meteorological Observations made on the Summit of Pike's Peak, January, 1874, to June, 1888. Pp. 475.—Observations of the New England Meteorological Society in the Year 1888. Pp. 99, with Charts.—Monthly Bulletins of the New England Meteorological Society. Cambridge, Mass.: Edward C. Pickering, Director.

Blackmar, Frank W. History of State Aid to Higher Education in the United States. Washington: Government Printing-Office. Pp. 343.

Blake, William P., New Haven, Conn. Mineralogical Notes (Verde Valley, Ariz.). Pp. 8.

Bray, Henry Truro. The Evolution of a Life from the Bondage of Truth to the Freedom of Reason. Chicago: Holt Publishing Co. Pp. 436. $2.

Brinton, Daniel G. On Etruscan and Libyan Names. A Comparative Study. Pp. 16.

Canadian Institute. Annual Report for 1889. Toronto: Charles Carpmael, President of the Council. Pp. 118.

Chisolm, Julian J., Baltimore. Persistent Headaches and how to Treat them. Pp. 12.

Clark, A. Arnold, Lansing, Mich. Germs, the Prevention of Consumption, etc. Pp. 16.

Clark, Kate Elizabeth. The Dominant Seventh. A Musical Story. New York: D. Appleton & Co. Pp. 164. 50 cents.

Coast and Geodetic Survey, United States. Tables for converting Customary and Metric Weights and Measures. Pp. 4.

Crawley, Edwin S. Elements of Plane and Spherical Trigonometry. Philadelphia: J. B. Lippincott Company. Pp. 159. $1.

Crocker, Uriel H., Boston. Excess of Supply: its Cause and its Results. Pp. 8.

Crookshank, Edgar M. History and Pathology of Vaccination. Philadelphia: P. Blakiston, Son & Co. 2 vols. Pp. 466 and 610, with Plates.

Ethnology, United States Bureau of. J. W. Powell, Director. Report, 1883–'84. Pp. 564.—Ibid., 1884–'85. Pp. 675, both with Maps and Plates.—The Circular, Square, and Octagonal Earthworks of Ohio. By Cyrus Thomas. Pp. 86, with Plates.—Textile Fabrics of Ancient Peru. By William H. Holmes. Pp. 17. Washington: Government Printing-Office.

Dead Heart, Souvenir of the (Lyceum Theatre, London). New York: Cassell & Co. Pp. 51, with Plates.

Ebers, Georg. Joshua, a Story of Biblical Times. Translated by Mary Safford. New York: W. S. Gottsberger & Co. Pp. 371.

Foster, Michael, and others, Editors. The "Journal of Physiology." Vol. XI, Nos. 1 and 2. Cambridge Scientific Instrument Company's Works, England. Pp. 160, with Plates. $5 a volume.

Gray, Henry, London. Random Catalogue of Americana and Colonians. Pp. 241.—Random Catalogue of Choice Books. Pp. 16.

Harrison, Louis Reeves. Rothermal. New York: American News Company. Pp. 281. 50 cents.

Iowa, State University of. Bulletin from the Laboratory of Natural History. (Anatomy of the Gorgonidæ and the Native Fishes of Iowa.) Iowa City. Pp. 76.

James, Edmund J. Federal Constitution of Germany. Philadelphia: University of Pennsylvania. Pp. 43. 50 cents.

Kansas Academy of Sciences. Transactions, 1887-'88. Topeka: B. B. Smyth, Librarian. Pp. 129.

Martin, H. Newell, and Brooks, W. K. Studies from the Biological Laboratory of Johns Hopkins University. Baltimore: N. Murray. Pp. 100, with Plates. $1.

Massachusetts Agricultural College. Twenty-seventh Annual Report. Pp. 99.

National Museum, United States. A Review of the Genus Xiphocolaptes of Lesson. Pp. 20. And of the Genus Sclerurus of Swainson. Pp. 10. Birds collected in the Galapagos Islands in 1888. Pp. 28. And Birds collected at certain other South American Islands in 1887-'88. Pp. 10. All by Robert Ridgway.—Descriptive Notes on New Genera and Species from the Lower Cambrian of North America. By Charles D. Walcott. Pp. 16.—New North American Acrididæ. By Laurence Bruner. Pp. 36, with Plate.—Contribution to the History of Pallas's Cormorant. By Leonard Stejneger and Frederick A. Lucas. Pp. 12.—Description of Two New Species of Snakes from California. By Leonard Stejneger. Pp. 5.—Report on the Batrachians and Reptiles collected in 1887-'88. By E. D. Cope. Pp. 7.—Descriptions of New Species of Fishes. Galapagos Islands and Coast of Colombia. By David Starr Jordan and C. H. Bollman. Pp. 34.—Catalogue of Insects collected in 1887-'88. By I. O. Howard.—Scientific Results of Explorations by the United States Fish Commission Steamer Albatross. By Dr. George Vasey. Washington: Government Printing-Office

New Jersey Agricultural College. Experiment Station, New Brunswick, Bulletin. Fungous Diseases of the Cranberry. By Byron D. Halsted. Pp. 40.

New York Agricultural Experiment Station, Geneva, Bulletin. Testing of Dairy Breeds. Pp. 44.

Noel, Hon. Edward. Natural Weights and Measures. London: Edward Stanford. Pp. 83, with Plates.

"P., G. W." American Whist. Illustrated. Boston and New York: Houghton, Mifflin & Co. Pp. 367. $1.75.

Pickering, Edward C. On the Spectrum of Zeta Ursæ Majoris. Pp. 2.

Rankin, Francis H., M. D. Hygiene of Childhood. New York: D. Appleton & Co. Pp. 140. 75 cents.

Richards, Edgar. Some Food Substances and Adulterants. Washington, D. C. Pp. 18.

Rochester, N. Y. Forty-second Annual Report of the Board of Education. Pp. 207.

Salomons, Sir David. Electric Light Installations and the Management of Accumulators. New York: D. Van Nostrand Company. Pp. 334. $1.50.

Sampson, Z. Sidney. Primitive Man. Boston: James H. West. Pp. 8. 10 cents.

Sapp, Hudson, Mansfield, Ohio. A New Revelation, Unequaled Theology. Pp. 164.

Savage, Minot J. Sermons on Life. (Wealth and Poverty; Mr. Bellamy's Nationalism.) Boston: George H. Ellis. Pp. 16 and 19. 5 cents each.

Small, Albion W. The Beginnings of American Nationality. Baltimore: Johns Hopkins University. Pp. 77. $1.

Shufeldt, R. W. Remarks upon Extinct Mammals of the United States. Pp. 38.—Progress in Avian Anatomy in 1888-'89. Pp. 5.—Osteology of Arctic and Sub-Arctic Water Birds. Pp. 28, with Plates.

Stewart, Hon. William N., United States Senate. Speech on Speculators in Money and Debts. Pp. 8.

Tennessee State Board of Health, Bulletin. Nashville. Pp. 20.

Wagner Free Institute of Science, Philadelphia, Transactions, 1889. Prof. Joseph Leidy, President.

Wake, C. Staniland. The Growth of the Marriage Relation. Boston: James H. West. Pp. 70. 10 cents.

White, Andrew Dickson, LL. D. Syllabus of Lectures on the Causes of the French Revolution. Philadelphia. Pp. 14.

Whitman, C. O., and Allis, Edward Phelps, Jr., Editors. "Journal of Morphology," December, 1889. Boston: Ginn & Co. Pp. 120.

POPULAR MISCELLANY.

The Disaster at Toronto.—On the evening of February 14th the larger portion of the University of Toronto was laid in ashes. Its governing body have met the disaster with commendable promptitude and spirit. Plans are afoot not only to rebuild the structure in its original beauty of outline, but to extend it for the accommodation of the ever-growing number of the university's students. Last summer the university was the home of the American Association. The cordial hospitality of its venerable principal, Sir Daniel Wilson, and his staff of professors, on that occasion, have done not a little to widen the circle of sympathy felt with Ontario's capital in its grievous loss.

Irish Holiday Customs.—A paper by Mr. James Mooney, on the "Holiday Customs of Ireland," presents the Celtic peasant in a different aspect from that under which he is exhibited in the English Unionist accounts of his misery and turbulence, and one which, we may easily believe with the author, is more really illustrative of his character and home life. The old customs are, however, decaying in Ireland as elsewhere, and many of the observances which were once general are now confined to remote mountain districts or live only in the memory of the older people. Yet others are still common throughout the country. As there is but little communication among the peasantry of different districts, except at the fairs in the summer-time, the customs common in one parish are sometimes entirely unknown in an-

other hardly ten miles distant. While a number of the holiday observances are more or less common to all the Aryan natives, the features more peculiarly Irish are mainly derived from the old Druidic worship. Aside from some essentially foreign customs not noticed in Mr. Mooney's paper, many of the genuine Irish observances have been considerably modified by English influences. This is especially true of the May-day and Christmas celebrations; and many holiday rhymes and children's rhymes, riddles, and other formulas—even in the remote parts, where Celtic is the ordinary language of the people—have been imported bodily from England. Mr. Mooney has also reprinted, from the "Journal of American Folk-Lore," a paper on the "Folk-Lore of the Carolina Mountains," which, while it can hardly be summarized, is full of matters of curious and quaint interest.

Ants and the Plants that harbor them.—In a paper read before the British Association on the *Humboldtia laurifolia* as an ant-harboring plant, Prof. Bower observed that the peculiar relations between plants and ants had been the subject of considerable observation from time immemorial. The literature on the subject could be traced as far back as 1750, and Captain Cook, in describing his voyages, distinctly alluded to the matter. In one place he said that he had seen on a certain tree a number of black ants which perforated the twigs, and, after eating out the pith, formed a lodging in the cavity, and yet the tree continued in a flourishing condition. In tropical climates there were many plants pre-eminently associated with ants. The Italian botanist Picari contended that the relationship was advantageous alike to the plants and to the ants. The former afforded shelter to the latter, and in some cases supplied them with food. In the course of a short discussion Dr. Tieman said there were five species of *Humboldtia* in tropical countries. The ants took advantage of the hollowness of the plants, but he did not think the latter derived any benefit from their presence.

Alcoholism and Consumption.—In three professional papers Prof. Thomas J. Mays exhibits relations between consumption and nervous disorder, and between consumption and alcoholism. The former connection is illustrated by the citation of numerous cases in medical practice, the deductions from which lead to the conclusion that "he who looks at the disease which goes under the name of pulmonary consumption solely from a pulmonary standpoint obtains but a very limited and distorted conception of its magnitude and nature; but that he who takes the view here indicated will realize that the lung affection is only a special manifestation of the disease which invades the whole body; and that all its diversified symptoms, such as fatigue and exhaustion, anorexia, dyspepsia, wasting, dyspnœa, sweating, diarrhœa, hæmoptysis, intercostal tenderness, hoarseness, aphonia, œdema, are not the consequences of the pulmonary disease, as is generally believed, but in all probability find a common bond of union in a general disorder of the peripheral nervous system." In the other aspect of the theory cases are cited to prove that "alcoholism and phthisis are not mere coincidences, but that they have a relationship so intimate that one may be converted into the other"; and that pulmonary phthisis can be produced through the toxic action of alcohol on the nervous system. "Such, then, being the relation between alcoholism and pulmonary phthisis, it is very readily understood why these two diseases should so frequently change places in different members or generations of the same family, and why they are so often associated with various other nervous disorders."

Old Panama Canal Projects.—The feasibility of cutting a canal across the Isthmus was discussed by William Paterson, in 1701, in connection with his Darien scheme, but only incidentally. He thought that the canal could be easily cut for six out of the eight leagues between the oceans, while the other two passages would be difficult. Humboldt, in a report made in 1799, enumerated nine different points at which the two oceans might be connected. Previous to this, in 1788, a passage between the two oceans for small craft was actually accomplished. The author of this achievement, says Mr. J. Stephen Jeans, in a paper on the subject, was the curate of Nevita, who induced his Indian flock to cut a trench between the upper streams of the San Juan River, near

Chirambira Bay, and the higher waters of the river Atrato, which flow into the Atlantic through Choco Bay, in the Gulf of Darien, so that they could pass from the Caribbean to the Pacific in their canoes. In carrying this passage into effect, the Arastradera, or summit level, a plain about three miles in width, formed by an interruption of the mountainous ridge, was cut across. The passage was, however, dangerous and difficult at all times, even for canoes, and the communication has now for many years been neglected and disused.

Land Tenures in China.—While the emperor theoretically owns all the land in China, the private owner has as absolute a property in it as he can have under any government. The tenures are military and common, the latter applying to far the largest proportion of the territory. It exists upon the conditions of payment of the land-tax, the supply on demand of statute labor to the authorities, and the payment of a fine on alienation. The land-tax is assessed in a fixed sum on the district magistrate, who recovers from the tenant, but is sometimes remitted in case of a great calamity. The supplying of statute labor has almost fallen into disuse. The fees are payable on the transfer of land by sale or mortgage, succession or inheritance. About half the soil is probably the property of the tenants who till it; but large tracts are also owned by "literati and gentry," who lease it to small farmers for a rental consisting of a proportion of the crops fixed according to the quality of the soil. The rents are paid as soon as the crop is harvested, and, being seldom in arrear, evictions are rare. The laws are all in favor of the tenant, who pays no taxes or rates, and takes everything, including his house. There is every possible variety of arrangement in the ownership of land. There are absolute sales and sales in which the vendor reserves the right to a share in a future rise in value; revocable and irrevocable sales; and dual ownership, in which one man owns the surface and the other the soil, and is liable for the taxes.

Refrigeration by Ammonia.—Ammonia has been very generally employed for refrigerating purposes in the United States and Germany, and to some extent elsewhere, for ten years or more. Other agents used for this purpose are methylic ether, Pictet's liquid, sulphur dioxide, and ether. Ammonia in its anhydrous condition possesses in an eminent degree the properties most desired in a refrigerant, for it boils at the low temperature of 37½° Fahr., while its latent heat of vaporization is 900°. Two distinct systems are employed in the use of ammonia, differing from one another in the method of securing the rejection of heat during condensation of the vapor, while the mere evaporating or refrigerating part of the process is the same in both. In the absorption process ammonia and water are vaporized together and then fractionally condensed by cooling. The water, condensing first, is caught and run back to the generator, while the nearly anhydrous ammonia is collected separately. With this process 200,000 units of heat per hour may be eliminated by the consumption of about one hundred pounds of coal, with a temperature in the refrigerator of about 20° F. In the compression process the ammonia vapor is drawn from the refrigerator and compressed by a pump and delivered into the condenser and liquefied at the temperature of the cooling water. It is more economical than the absorption process, and is adequate to the elimination of 240,000 units per hour. The process is applied to ice-making and to the cooling of stores and rooms.

The Tahl-tan Indians of British Columbia.—An account of this people by Mr. J. C. Callbreath, included in a report of an exploration by George M. Dawson, gives their maximum height as about five feet seven and a half inches, and maximum girth of chest about thirty-seven inches. Their heads are small, and the feet and hands are generally small, as are also the wrist and ankle, especially in the women. Traders sell more No. 2 women's and No. 6 men's shoes than any other sizes. No men's hats above No. 7 are sold. Half-breeds from a white man and a Tahl-tan woman are more like the father than the mother, and three generations where the father is in every case white seem to obliterate all trace of Indian blood. The children are more cunning and clever when young than those of the white race, but grow dull as they age. Yarn is spun from the wool of

the mountain goat and is woven into excellent blankets, which are highly colored and ornamented. The process of boiling water with hot stones in baskets or wooden bowls was formerly common. The dances of the Tahl-tan are tame affairs compared with those of the coast tribes, but their musical capabilities are considerable. Kinship, so far as marriage or inheritance of property goes, is with the mother exclusively, and the father is not considered a relative by blood. Mr. Callbreath tells of an instance where a rich Indian would not go out or even contribute to send others out to search for his aged and blind father who was lost and starving in the mountains. Not counting his father as a relative, he said, "Let his people go and search for him." Yet this man was a more than average good Indian. A man's female children are as much his property as his gun, and he sells them to whom he pleases. If the husband pays for his wife in full and she dies, even ten years afterward, the father is bound to supply a wife, if he have any more eligible daughters, without additional payment. Their laws are based on the principle that any crime may be condoned by a money payment. Their religious belief was simply what their medicine-men might lay down for them from time to time, and the idea of a Supreme Being was very obscure if not altogether wanting. They have no fear of death except from dread of the pain of dying. There is a belief propagated by their medicine-men that the otter gets inside their women and sometimes causes death by a lingering illness, in other cases allowing the woman to live on till she dies from some other cause.

An African Tribe of Promise. — The Benge are a very intelligent and pleasant tribe which Lieutenant R. Kund's exploring party found occupying an "immense clearing" in the midst of the Congo wilderness. Their village, surrounded by large manioc-fields, consisted of a street about fifty yards wide extending farther than the eye could reach. The huts of the villagers squarely faced the street on either side, and behind them were well-kept plantations of bananas, backed by oil palms, with the giant trees of the forest looming in the rear of all. The race is of a very fine type, with a brownish-red complexion some degrees removed from black, fine, manly features with an intellectual cast, and cleanly and orderly in habits. They are good hunters, and practice wood-carving and other arts with a skill that would do credit to Europeans. They have attained in all respects a higher standard of civilization than is to be found among the other tribes of West Africa. They exhibited none of the stupid superstition in the presence of the travelers which had appeared in other places, and showed no signs of cannibalism or fetichism or coarse idolatry.

Effect of a Cobra's Bite.—The taxidermist of the Victoria Museum was bitten in the hand by a cobra, from which the poison-bag had been extracted, while feeding it. Supposing the bite to be harmless, he took no notice of it till pain and nausea began. Then all the usual antidotes were tried without effect. The man lost the power of speech, became paralyzed in his muscular system, and ceased to breathe. Artificial respiration was applied for eight hours, after which he began to breathe again and gradually regained consciousness. After two days he was able to tell his friends that he had been fully aware of all that was going on during the efforts to restore him, but had not been able to move a muscle or to make his feelings known. He could see and hear and feel, but not move or twitch. He was afterward attacked by high fever and inflammation of the lungs, from which he died on the Sunday following the Wednesday on which he was bitten.

Dust essential to Fogs.—Nearly ten years ago John Aitken, of Edinburgh, proved experimentally that the presence of dust was essential to the formation of fog and cloud. He connected two receivers, one containing common air, the other air freed from dust by passing through cotton-wool, with a boiler. When steam was admitted into the first receiver, a fog formed within it; but when allowed to enter the one containing filtered air, not the slightest cloudiness was produced. Particles of water-vapor do not combine with each other to form a cloud-particle, but must have a free surface on which to condense. The particles of dust serve as nuclei on which the vapor condenses,

and hence the more abundant the dust the more dense the cloud. When the vapor in the second receiver was brought by circulation against the sides of the receiver, it gradually condensed on these surfaces. The density of the fog formed in common air shows what a large amount of dust is present every day in the air around us. But the particles of fog do not represent all the dust-particles in the air. If enough steam is blown into a receiver full of common air to produce a dense fog, and after the fog has settled more steam is blown in, another fog will form on the dust which still floats in the air. If this is repeated a number of times, a less dense and coarser-grained fog forms each time, till at last no fog is seen, but the condensed vapor falls as rain. These dust-particles are not the motes that we see in the path of a sunbeam; for, when common air is passed through a flame, these motes disappear, but the air still remains a good medium for fogs. It is a finer kind of dust which furnishes the fog and cloud nuclei. The products of combustion are fog-producers, and especially the vapor from the burning of sulphur.

Gem Minerals of Canada.—Although, according to Mr. George F. Kunz's paper on "Precious Stones, Gems, and Decorative Stones in Canada and British North America," Canada can hardly be called a gem-producing country, it furnishes a number of stones that are of more than passing interest to the mineralogist, and of some value in jewelry and the arts. A number of gem minerals, not of gem quality, are found in examples of such size and perfection that they have been given prominent places in cabinets, and are even more prized as specimens than cut stones from other localities. Their mineralogical value gives them no small commercial importance. Of such are magnificent zircon crystals, occurring as individuals up to fifteen pounds in weight, and many finer ones weighing a pound, as well as beautiful twin crystals of the same mineral; black titanite in simple and trimmed crystals up to seventy pounds each; "vast quantities of amethyst" from Lake Superior; ouvorsovite or green chrome garnet from Orford, and white garnet crystals from near Wakefield; and apatite crystals, one weighing over five hundred pounds, of great beauty, of which the rich green variety, especially, would do to work into ornaments similar to those made from fluorite. Only a small part of the territory of the Dominion has been examined with reference to these stones; and with the discovery of new localities important additions to the list may be anticipated.

The Sliding Railway.—The *Chemin de Fer Glissant*, or sliding railway, at the Paris Exhibition, according to a description by Sir Douglas Galton in the British Association, is based on the two principles of causing the carriage to slide on a thin film of water introduced between the sledge-plates on which it rests; and the propulsion of the sliding train by horizontal columns of water acting through hydrants placed at intervals on the line. The system was originally designed by Girard in 1861, who made a line at his own private house, where he had an inclination of one foot in twenty. The results he obtained seemed to justify the application of the system in special cases on a paying basis. He acquired a concession in 1869 for a railway from Calais to Marseilles, to which a subvention was afterward attached. But the War of 1870 resulted in the destruction of the railway by the German army, and in the death of M. Girard in 1871. In 1885 M. Barré purchased the drawings left by M. Girard, and introduced an improvement which he considered would make the system more workable. A line on this improved system was established in the Paris Exhibition, about two hundred yards long, and trains were run upon it.

Properties of the Kola-Nut.—Kola-nuts, or the seeds of *Sterculia acuminata*, are allied in composition to cocoa, coffee, and tea, but contain a relatively large amount of caffeine. They are credited with strong tonic and nervous stimulant properties; with counteracting and removing the sense of exhaustion after fasting and fatigue; with having antagonistic reaction to alcohol; and with a purifying influence on water. Their value as a therapeutic and dietetic agent has been tested by Surgeon R. H. Firth, who concludes that kola is not a food; that it increases total urinary water, has a stimulant action on the nervous system, temporarily strengthens the

heart-beat, and increases the arterial tension. In times of exertion and fasting it wards off the sense of mental and physical depression and exhaustion. The author has not gained positive results respecting its therapeutic qualities. Its action in purifying water is mechanical, and not more effective than that of other mucilaginous seeds.

Raining Spiders' Webs.—Falls or showers of gossamer spiders' webs have been recorded in different parts of the world. White describes several in his "Natural History of Selborne." Darwin mentions a shower which he observed from the deck of the Beagle off the mouth of the Rio Plata, when the vessel was sixty miles from land. A general fall of spiders' webs is said to have been noticed a few years ago in some of the towns of Wisconsin, which seemed to come from over the lake. The webs were strong in texture, very white, varied from sixty feet in length to mere specks, and were seen as far up in the air as the power of the eye could reach. The shower may have been due to an unusual excursion of the familiar geometric spider, a species which has the same power as the gossamer of shooting webs that float upon the air, and sometimes serve as an air-raft for the producer.

NOTES.

The scientific courses at Indiana University, of which our contributor, David Starr Jordan, is president, include departments of physics, with classes in physics proper, physical measurements, and meteorology; chemistry, with qualitative and quantitative analysis, special work, and water analysis; geology, with mineralogy, topographical geology, and field-work; zoology, with many classes, including theories of evolution, the critical study of Darwin's "Origin of Species," and original research; and botany, with six classes and advanced and original work in the senior year on a special subject. Since it was opened 3,816 students have been taught in the college departments of the university.

"Cocoanut day" is celebrated in most parts of India during the full moon in August. On that day numbers of nuts are thrown into the sea as an offering to the Hindoo god. Occasionally one meets with deformed nuts, consisting of the husks with small nuts having no kernel inside. The natives attribute this blighting to the tree-frog, which, by smelling the flower, can prevent the fruit from coming to maturity.

A curious survival of customs was illustrated in Lisbon some days after the funeral of the late King Luis of Portugal. A funeral procession, composed of officers, military, and citizens, marched through the streets to places where platforms covered with black cloth had been erected. Four shields, on which were painted the royal arms, were borne aloft on long staves. On arriving at the platforms, the principal persons took their places upon them; one of the shield-bearers, advancing to the front and chanting, "Weep, O Portuguese, for your king, Dom Luis I, is dead," dashed his shield to the ground with such violence that it was shattered. This was repeated at each platform, while the bells were tolled during the whole ceremony. The proceedings were closed with a requiem service.

At the recent annual meeting of the Rational Dress Society, Viscountess Harberton, the president, said that during the past year she had hardly met with any expressions of approval from women with regard to their present system of dress. Most of the remarks she had heard had been denunciatory of the weight, discomfort, or dragging, or—particularly from young women—the cold when evening dress was worn. This was cheering, because it marked a growing realization of the uncomfortableness of present costumes. In the speaker's opinion, the only hope of reform lay in a radical change to some kind of dress having the clothing for the legs dual; it should clearly follow the shape of the form it was meant to cover.

According to Mr. R. Andree, our Indians use rising smoke as a means of giving signals, and have a system of alternately smothering the column and letting it rise freely for transmitting different messages. A similar method is used in New Guinea and Australia. The great variety of the messages communicated by drums in the Cameroons and other parts of Africa have been described in the "Monthly." The Gallas, south of Abyssinia, have drums stationed at certain points of the roads leading to the neighboring states, at which watchmen are appointed to sound the alarm in case of threatened invasion. In New Guinea the natives learn from the rapidity and rhythm of the blows on drums what is happening—whether an attack, death, or a festival.

The opinion is expressed by Mr. Elliot, in his last Meteorological Report for India, that the period of minimum sun-spots is associated in that country with the largest and most abnormal variations of meteorological conditions and actions. Thus the snow was exceptionally heavy in the northwest Himalayas in the winters of 1866, 1876, and 1877. The most striking and disastrous famines have also occurred near the minimum sun-spots, as those of Orissa in 1866, Behar in 1874, and Madras in 1876–'77. So,

too, with cyclones, as at Calcutta in 1864, when sixty thousand people were drowned in the storm-wave, and Backerganj in 1876, when one hundred thousand were drowned.

THE experiment has been tried in Moscow, Russia, with success, of using carrier-pigeons to convey negatives of photographs taken in a balloon. The plates were packed in light-proof papers and tied to the feet of pigeons, who speedily took them in good order to the station on the ground.

MEDICAL geology and climatology are mentioned by the "Lancet" as departments of the science to which more attention might be paid than is. Their usefulness is illustrated by the recently published studies of Mr. Alfred Haviland on the distribution of cancer in the British Islands.

THE undue increase in all the learned professions in Germany is the subject of a pamphlet by Prof. W. Lexis, of Berlin. All the theological faculties, except the Roman Catholic, are increasing "to an alarming extent." The average number of medical students for the whole empire—2,675—was increased in 1888–1889 by 2,344. If a proportionate increase takes place in the number of licenses, the year's new doctors will rise from the average of 456 to more than 800. A prize offered by one of the Teachers' Associations for the best essay on the overcrowding of the learned professions and the means of remedying it, was given to two papers out of seventy-six sent in, which are to be published in a book.

AN apparatus for providing a steady platform at sea for guns, search-lights, telescopes, etc., was described by Mr. Beauchamp Tower in the British Association.

OBITUARY NOTES.

EX-PRESIDENT MARTIN B. ANDERSON, who died at Lake Helen, Fla., February 26th, was a scholar who had made himself eminent in many fields of thought and activity. He was born in Brunswick, Maine, in 1815; was graduated from Waterville College, now Colby University, in 1840; studied theology; preached, taught, and served as editor of the "New York Recorder," a Baptist paper, till 1853, when he was chosen President of the University of Rochester, where his after-life was spent. He instituted a course of lectures in intellectual philosophy, which were continued till he retired, in consequence of ill health, a year or two ago; also a course of historical lectures; and under the head of political economy he treated various questions affecting money, taxation, etc., and free trade and protection. His studies extended to questions of constitutional law, and covered the arts. He was prominent in all Baptist denominational enterprises, and served the State on several civil commissions. In fact, as the "Evening Post" well says, "he was one of those men who take all knowledge for their province, and never wearied of enriching his mind with stores of all descriptions, which he distributed with lavish impartiality among the students under his charge."

AMONG the recent deaths of scientific men abroad are those of M. L. Taczanowski, of Warsaw, a distinguished ornithologist, author of a book on the birds of Peru; M. Neumayr, of Vienna, geologist, who was not yet forty years of age; and M. Otto Rosenberger, astronomer, who had been connected with the observatory at Halle since 1831.

"LA NATURE," of February 15th, mentions the death of M. Buys Ballot, of Utrecht, one of the most eminent meteorologists of the time, at the age of seventy-three years. He gave much attention to the study of data for facilitating weather predictions — the movement of cyclones, the direct observation of clouds, and all the "natural symptoms of the weather." He propounded several meteorological laws or maxims which bear his name, and probably had an equal part with any other student in giving shape to the present system of observation and investigation in that science.

MAJOR PETER EGERTON WARBURTON, whose name is associated with the hazardous but successful expedition which he made across Australia in 1873, died recently in Adelaide, in his seventy-sixth year. His exploring party suffered terrible privations during their march, and were not heard of for twelve months. Major Warburton received the gold medal of the Royal Geographical Society and various honors in recognition of his contributions to our knowledge of Australia.

SIR HENRY YULE, an Englishman, eminent in geographical research, died December 31st, in his seventieth year. In his annotated edition of Marco Polo's travels he made contributions of the most valuable character to geographical and antiquarian lore.

M. EUGÈNE DESLONGCHAMPS, a French paleontologist, who died last December, was the son of another paleontologist, Prof. Eudes Deslongchamps, was Professor of Zoölogy and Paleontology at Caen, and was the author of several memoirs on the paleontological fauna of Normandy.

DR. KARL EDUARD VENUS, an eminent German entomologist, died at Dresden, December 13th. He was the founder of the Entomological Society "Iris" at Dresden.

M. GUSTAVE HIRN, an eminent French physicist, mathematician, and astronomer, died January 14th, in the seventy-fifth year of his age. He was the author of a work of considerable repute on the "Constitution of Celestial Space."

INDEX TO VOLUME XXXVI.

too, with cyclones, as at Calcutta in 1864, when sixty thousand people were drowned in the storm-wave, and Backerganj in 1876, when one hundred thousand were drowned.

THE experiment has been tried in Moscow, Russia, with success, of using carrier-pigeons to convey negatives of photographs taken in a balloon. The plates were packed in light-proof papers and tied to the feet of pigeons, who speedily took them in good order to the station on the ground.

MEDICAL geology and climatology are mentioned by the "Lancet" as departments of the science to which more attention might be paid than is. Their usefulness is illustrated by the recently published studies of Mr. Alfred Haviland on the distribution of cancer in the British Islands.

THE undue increase in all the learned professions in Germany is the subject of a pamphlet by Prof. W. Lexis, of Berlin. All the theological faculties, except the Roman Catholic, are increasing "to an alarming extent." The average number of medical students for the whole empire—2,675—was increased in 1888–1889 by 2,344. If a proportionate increase takes place in the number of licenses, the year's new doctors will rise from the average of 456 to more than 800. A prize offered by one of the Teachers' Associations for the best essay on the overcrowding of the learned professions and the means of remedying it, was given to two papers out of seventy-six sent in, which are to be published in a book.

AN apparatus for providing a steady platform at sea for guns, search-lights, telescopes, etc., was described by Mr. Beauchamp Tower in the British Association.

OBITUARY NOTES.

EX-PRESIDENT MARTIN B. ANDERSON, who died at Lake Helen, Fla., February 26th, was a scholar who had made himself eminent in many fields of thought and activity. He was born in Brunswick, Maine, in 1815; was graduated from Waterville College, now Colby University, in 1840; studied theology; preached, taught, and served as editor of the "New York Recorder," a Baptist paper, till 1853, when he was chosen President of the University of Rochester, where his after-life was spent. He instituted a course of lectures in intellectual philosophy, which were continued till he retired, in consequence of ill health, a year or two ago; also a course of historical lectures; and under the head of political economy he treated various questions affecting money, taxation, etc., and free trade and protection. His studies extended to questions of constitutional law, and covered the arts. He was prominent in all Baptist denominational enterprises, and served the State on several civil commissions. In fact, as the "Evening Post" well says, "he was one of those men who take all knowledge for their province, and never wearied of enriching his mind with stores of all descriptions, which he distributed with lavish impartiality among the students under his charge."

AMONG the recent deaths of scientific men abroad are those of M. L. Taczanowski, of Warsaw, a distinguished ornithologist, author of a book on the birds of Peru; M. Neumayr, of Vienna, geologist, who was not yet forty years of age; and M. Otto Rosenberger, astronomer, who had been connected with the observatory at Halle since 1831.

"LA NATURE," of February 15th, mentions the death of M. Buys Ballot, of Utrecht, one of the most eminent meteorologists of the time, at the age of seventy-three years. He gave much attention to the study of data for facilitating weather predictions — the movement of cyclones, the direct observation of clouds, and all the "natural symptoms of the weather." He propounded several meteorological laws or maxims which bear his name, and probably had an equal part with any other student in giving shape to the present system of observation and investigation in that science.

MAJOR PETER EGERTON WARBURTON, whose name is associated with the hazardous but successful expedition which he made across Australia in 1873, died recently in Adelaide, in his seventy-sixth year. His exploring party suffered terrible privations during their march, and were not heard of for twelve months. Major Warburton received the gold medal of the Royal Geographical Society and various honors in recognition of his contributions to our knowledge of Australia.

SIR HENRY YULE, an Englishman, eminent in geographical research, died December 31st, in his seventieth year. In his annotated edition of Marco Polo's travels he made contributions of the most valuable character to geographical and antiquarian lore.

M. EUGÈNE DESLONGCHAMPS, a French paleontologist, who died last December, was the son of another paleontologist, Prof. Eudes Deslongchamps, was Professor of Zoölogy and Paleontology at Caen, and was the author of several memoirs on the paleontological fauna of Normandy.

DR. KARL EDUARD VENUS, an eminent German entomologist, died at Dresden, December 13th. He was the founder of the Entomological Society "Iris" at Dresden.

M. GUSTAVE HIRN, an eminent French physicist, mathematician, and astronomer, died January 14th, in the seventy-fifth year of his age. He was the author of a work of considerable repute on the "Constitution of Celestial Space."

INDEX TO VOLUME XXXVI.

INDEX.

ARTICLES MARKED WITH AN ASTERISK ARE ILLUSTRATED.

PAGE

Abbott, Charles C. The Descendants of Palæolithic Man in America..... 145
African Tribe of Promise, An. (Misc.)..... 861
Agriculture and the Single Tax. H. White..... 481
Alchemist's Gold. A. De Rochas..... 814
Alcoholism and Consumption. (Misc.)..... 859
Allen, Grant. Plain Words on the Woman Question..... 170
Andrews, Miss E. F. Grant Allen on the Woman Question. (Corr.)..... 552
Animal Language. (Misc.)..... 427
Ants and the Plants that harbor Them. (Misc.)..... 859
Arid Regions, Our, and the Rainfall. (Misc.)..... 572
Armstrong, Mrs. M. F. The Mission of Educated Women..... 601
Arngrimsson, Frimann B. Sloyd: its Aim, Method, and Results*..... 784
Asbestus, Canadian, its Occurrence and Uses. J. T. Donald..... 526
Assassination, The History of the Doctrine of. (Misc.)..... 285
Atkinson, Edward. The Art of Cooking*..... 1
" The Future Situs of the Cotton Manufacture of the United States*..... 289
Australians, Outdoor Tastes of the. (Misc.)..... 139

Beauty, The, of Childhood. (Misc.)..... 572
Bellite. (Misc.)..... 280
Benton, Joel. The Decadence of Farming..... 27
Benton, Warren G. The Taouist Religion..... 329
Birds with Teeth.* Otto Meyer..... 382
Books noticed:
Adams, Muyron. The Continuous Creation..... 849
Agriculture, Commissioner of. Report for 1888..... 129
American Journal of Psychology..... 712
Andrews, Charles M. The River Towns of Connecticut..... 274
Andrews, E. B. Institutes of Economics..... 708
Anthropological Society. The Aborigines of the District of Columbia and the Lower Potomac..... 566
Arena, The..... 855
Arkansas, Report of the Geological Survey for 1888. Vols. II and III... 129
Aryan Sun-Myths the Origin of Religions..... 564
Atkinson, Edward. The Industrial Progress of the Nation..... 709
Attfield, John. Chemistry: General, Medical, and Pharmaceutical..... 418

Books noticed: PAGE

Bagehot, Walter. Plan for assimilating the English and American Money 420
Baker, C. W. Monopolies and the People 563
Baldwin, James M. Handbook of Psychology: Senses and Intellect 270
Barnard, Charles. Graphic Methods in Teaching 568
Becker, G. F. Geology of the Quicksilver Deposits of the Pacific Slope, with an Atlas 561
Bell, A. M. Popular Manual of Vocal Physiology and Visible Speech 856
Bell, Clark. The Recent Judicial Departure in Insanity Cases 272
Bilgram, Hugo. Involuntary Idleness 421
Boston Society of Natural History. Proceedings, Vol. XXIV 565
Bowditch, H. P. Hints for Teachers of Physiology 272
Brinton, D. G., and A. S. Anthony. A Lenâpé-English Dictionary 709
Brown, W. L. Manual of assaying Gold, Silver, Copper, and Lead Ores. 420
Buckham, T. R. The "Right and Wrong" Test in Insanity 273
Collins, F. Howard. Epitome of the Synthetic Philosophy 850
Commonwealth, The 273
Cope, E. D. The Batrachia of North America 274
Cosmic Law of Thermal Repulsion, The 712
Crooker, J. H. Problems in American Society 852
Crothers, T. D. Should Inebriates be punished by Death for Crime? 278
Crusader Programs 855
Darwin, Charles. The Structure and Distribution of Coral Reefs 124
Daudet, Alphonse. La Belle Nivernaise 278
Davies, N. E. Foods for the Fat 854
Davis, Gualterio G. Ligeros Apuntes sobre el Clima de la República Argentina 563
Doctor of Medicine, A. Home-Rule and Federation 855
Donisthorpe, Wordsworth. Individualism, a System of Politics 705
Douglas, S. A. An American Continental Commercial Union or Alliance. 569
Dunton, Larkin, Editor. The World and its People. Book I, First Lessons. Book II, Glimpses of the World 856
Dumas, A. Les Trois Mousquetaires 856
Eggleston, Edward. A First Book in American History 417
Ethnology, Bureau of. Sixth Annual Report, 1884–'85 268
Evolution 712
Ferrel, William. A Popular Treatise on the Winds 415
Fish and Fisheries, Commissioner of. Report for 1886 419
Flagg, Isaac. Iphigenia among the Taurians 127
Foster, W. E. References to the United States Constitution 857
Fothergill, J. M. The Town-Dweller 852
Fullerton, Anna M. A Handbook of Obstetrical Nursing 562
Globe, The 568
Gobin, A. La Pisciculture en Eaux Douces 853
Gordon, Anna A. Songs of the Young Women's Christian Temperance Union 855
Gore, J. H. A Bibliography of Geodesy 567
Gould, G. M. Eye-strain 854
Gouvy, M. A., Jr. The Construction of Cupolas for the Melting of Pig-Iron 854

Books noticed: PAGE
Gray, Asa. Scientific Papers of, selected by C. S. Sargent..... 266
Great Words from Great Americans..... 128
Greene, Homer. Coal and the Coal Mines..... 561
Grove, George. A Dictionary of Music and Musicians. Appendix..... 271
Haferkorn, H. E., and Paul Heise. Handy Lists of Technical Literature. Part I..... 271
Hague, Addison, Irregular Verbs of Attic Prose..... 128
Harris, W. T. Introduction to the Study of Philosophy..... 707
Harrison, J. T. On the Creation and Physical Structure of the Earth. 853
Haworth, E. The Chemistry of Narcotics..... 712
Harvard College, Observatory of. Meteorological Observations, 1840–'88. 567
" Observations made at the Blue Hill Meteorological Observatory in 1888..... 568
Henry, Mrs. S. M. I. Frances Raymond's Investment..... 855
" The Unanswered Prayer..... 855
Hensoldt, H. Meteorites and what they teach us..... 565
Hill, Robert T. Check-List of the Invertebrate Fossils from the Cretaceous Formations of Texas. Part I..... 712
" Neozoic Geology of Southwestern Arkansas..... 129
" Paleontology of the Cretaceous Formations of Texas. Part I..... 712
Hinman, Russell. Eclectic Physical Geography..... 709
Hiorns, A. H. Iron and Steel Manufacture..... 420
Hough, W. On the Preservation of Museum Specimens..... 711
Hubert, P. G., Jr. The Nursery Lesson-Book..... 421
Journal of Morphology. Vol. III, No. 1..... 567
Journal of Physiology, The. Vol. X..... 416
Inventor's Manual..... 854
Kansas State Agricultural College Experiment Station. Report of the Botanical Department..... 272
Kapp, Gisbert. Alternate-Current Machinery..... 420
Kent, Charles W. Elene..... 127
Klemm, L. R. European Schools..... 416
Krafft-Ebing, R. von. An Experimental Study in the Domain of Hypnotism..... 420
Kunz, G. F. Meteoric Iron..... 713
Lagrange, F. Physiology of Bodily Exercise..... 848
Laing, S. Problems of the Future, and Essays..... 707
Lauridsen, Peter. Vitus Bering, the Discoverer of Bering Strait..... 421
Lloyd, J. Hendric. The Insanity of Oscar Hugo Webber..... 272
McGee, W J. An Obsidian Implement from Pleistocene Deposits in Nevada..... 566
" The World's Supply of Fuel..... 565
M'Kendrick, John Gray. Special Physiology..... 851
Macoun, John. Catalogue of Canadian Plants. Parts I to IV..... 269
Mahaffy, John P., and John H. Bernard. Kant's Critical Philosophy for English Readers..... 127
Mahrenholtz-Buelow, Baroness. The Child and Child-Nature..... 420
Mason, O. T. Cradles of the American Aborigines..... 711
" The Human Beast of Burden..... 711

Books noticed: PAGE

Mills, Wesley. A Text-Book of Animal Physiology 853
Modern Science Essayist 273
Morgan, T. J. Studies in Pedagogy 560
Moses, Bernard. The Federal Government of Switzerland 126
Müller, F. Max. Natural Religion 125
Neal, J. C. The Root-knot Disease 567
Newberry, J. S. Fossil Fishes and Fossil Plants of the Triassic Rocks of New Jersey and the Connecticut Valley 562
Newcomb, G. B. Teaching School Children to Think 564
New Review, The 270
New York State Board of Charities. Report of the Standing Committee on the Insane 272
Nichols, W. F. Topics in Geography 421
Observatorio Nacional Argentino, Resultados del 272
Parkes, Louis C. Hygiene and Public Health 417
Parrish, Joseph. The Legal Responsibility of Inebriates 273
Patten, S. N. The Rational Principles of Taxation 857
Peabody Museum of American Archæology and Ethnology. Palæolithic Man in Eastern and Central America 566
Peacocke, J. M. The Disposal of the Dead 569
Peck, John Lord. The Kingdom of the Unselfish 128
Phyfe, W. H. P. Seven Thousand Words often mispronounced 710
Pilling, J. C. Bibliography of the Eskimo Language 855
" Bibliography of the Siouan Languages 855
" Bibliography of the Iroquoian Languages 855
" Bibliography of the Muskhogean Languages 855
Pope, F. L. Evolution of the Electric Incandescent Lamp 420
Porter, J. H. Artificial Deformation of Children 711
Proctor, Richard A. Strength: How to get Strong and keep Strong ... 419
Prudden, T. Mitchell. The Story of the Bacteria 419
Purinton, D. B. Christian Theism 559
Redway, J. W. The Teacher's Manual of Geography 421
Renton, A. Wood. Testamentary Capacity in Mental Disease 273
Richards, Mrs. Ellen H. Domestic Economy in Public Education 568
Richards, John. A Manual of Machine Construction 126
Rothschild, M. D. Handbook of Precious Stones 713
Russell, I. C. Subaërial Decay of Rocks, and Origin of the Red Color of Certain Formations 567
Scott, R. P. Cycling Art, Energy, and Locomotion 422
Shaler, N. S. The Geology of Nantucket 567
Shufeldt, R. W. Osteology of Arctic and Sub-Arctic Water-Birds 712
" Osteology of Tubinares and Steganopodes 711
" Studies of the Ardeinæ 712
" Studies of the Macrochires 565
Smithsonian Institution. Accounts of Progress in Anthropology, Chemistry, Geography and Exploration, North American Geology, Mineralogy, Physics, Vulcanology and Seismology, Zoölogy 710
" " Bibliography of North American Paleontology. 710
" " Report on Exchanges 710

Books noticed: PAGE
Society for Political Education. Questions for Debate..... 569
Sonrel, A., and J. W. Fewkes. The Anatomy of Astrangia Danæ..... 565
Stearns, R. E. C. Ethno-Conchology: A Study of Primitive Money... 711
Steinitz, W. The Modern Chess Instructor. Part I..... 127
Stillman, J. W. God and the Universe..... 569
Sun and Shade..... 130
Symonds, Brandreth. Manual of Chemistry..... 128
Taylor, Thomas. Twelve Edible Mushrooms..... 272
Thackeray, S. W. The Land and the Community..... 559
Thomas, Cyrus. Aids to the Study of the Maya Codices..... 269, 272
Tillman, S. E. Elementary Lessons on Heat..... 128
Torrey, Bradford. A Rambler's Lease..... 565
True, Frederick W. A Review of the Family Delphinidæ..... 271
Upham, W. Glaciation of Mountains in New England and New York.. 712
" Marine Shells in the Till near Boston..... 712
" The Structure of Drumlins..... 712
Wachsmuth, C., and F. Springer. Discovery of the Ventral Structure of Taxocrinus and Haplocrinus..... 713
Ward, H. M. Timber and some of its Diseases..... 708
Ward, L. F. Some Social and Economic Paradoxes..... 855
Wells, David A. Recent Economic Changes..... 413
White, C. A. Invertebrate Fossils from the Pacific Coast..... 566
" The North American Mesozoic..... 565
Willard, Miss F. E. The Year's Bright Chain..... 855
Winchell, N. H. Natural Gas in Minnesota..... 712
Winslow, Arthur. Geology of the Coal Regions of Arkansas..... 129
Woodward, R. S. Formulas and Tables to facilitate the Construction of Maps..... 566
" Latitudes and Longitudes of Certain Points in Missouri, Kansas, and New Mexico..... 566
" On the Form and Position of the Sea-Level..... 566
Botany as a Disciplinary Study. (Misc.)..... 716
Bottle, a Glass, The Evolution of.* C. Hanford Henderson..... 154
Bridge, the Modern Railway, The Evolution of.* C. D. Jameson..... 461
Brooks, W. K. The Lucayan Indians*..... 88
Browne, James Crichton. Responsibility in Mental Disease..... 81

Cahall, William C. The Royal Society of England..... 226
Cambodia, A Glance at. (Misc.)..... 428
Cat-Goddess, The City of the. (Misc.)..... 281
Cave Life, The Effect of, on Animals. A. S. Packard..... 389
Chemical Prologue, A. C. H. Henderson..... 668
Chemist's, A, Services to Mankind. (Misc.)..... 574
Chidsey, Charles E. The Mysterious Music of Pascagoula..... 791
Children, Mental and Physical Training of. Jessie O. Waller..... 213
" The Law's Neglect of. (Misc.)..... 131
Chinese Problem, New Phases of the. W. B. Farwell..... 181
Chinese Silk-Lore.* Tcheng-Ki-Tong..... 500
Chinese Theory of Evolution, The.* A. M. Fielde..... 397
Chrysanthemums.* J. Dybowski..... 531

PAGE
Clark University. (Misc.) ... 717
Clarke, Miss Helen A. The Mental Bias of Witnesses. (Corr.) ... 120
Cobra's Bite, Effect of a. (Misc.) ... 861
Colorado River of Texas, The. (Misc.) ... 718
Comparative Mythology. A. D. White ... 433, 577
Consumption, Open-Air Travel for. (Misc.) ... 715
Cooking, The Art of.* Edward Atkinson ... 1
Co-operation, A Lesson in. C. N. Ousley ... 821
Correction, A. J. Jastrow. (Corr.) ... 409
Cotton Fiber, The. (Misc.) ... 574
Cotton Manufacture of the United States, The Future Situs of the.* Edward Atkinson ... 289
Country Life, Past and Present. (Misc.) ... 134
Creatures, Wild, of the Alps. (Misc.) ... 133
Cretaceous Inland Sea, The. (Misc.) ... 424
Crofter's Question, The. (Misc.) ... 138
Cyclopædias, Old. (Misc.) ... 277

Dana, James D. The Name Silurian in Geology. (Misc.) ... 276
Darwin, An Orthodox Compliment to. (Misc.) ... 425
Darwin on the Fuegians and Patagonians* ... 744
Davis, Charles S. Public Schools and Crime. (Corr.) ... 700
Deep-Sea Life, The Condition of. (Misc.) ... 285
Doctor and Patient in Ancient Hispaniola. (Misc.) ... 134
Domestic Economy, Science in. (Editor's Table) ... 123
Donald, J. T. Canadian Asbestus: Its Occurrence and Uses ... 526
Dragons, Fabled and Real.* M. Maindron ... 808
Dust essential to Fogs. (Misc.) ... 861
Duthiers, H. de Lacaze. Old and New Methods in Zoölogy ... 19
Dybowski, Jean. Chrysanthemums* ... 531
" The Rare Forms of Orchids* ... 359

Education, Is, opposed to Motherhood? Miss A. B. Tweedy ... 751
Ellis, A. B. The Indwelling Spirits of Men ... 794
" The Lucayan Indians. (Corr.) ... 701
Ether, Structure of the. (Misc.) ... 132
Ethics, Absolute Political. Herbert Spencer ... 608
Ethics and Religion. C. H. Toy ... 727
Every-day Science. (Editor's Table) ... 264
Evolution and Disease. (Misc.) ... 285
Example in Moral Teaching. (Editor's Table) ... 847
Exercise for Chest Development. F. Lagrange ... 522
Experimental Fields at Rothamstead. (Misc.) ... 429

Farming and the Tariff. J. R. Thurston. (Corr.) ... 408
Farming, Decadence of, in England. M. B. C. True. (Corr.) ... 553
Farming, The Decadence of. Joel Benton ... 27
Farwell, Willard B. New Phases of the Chinese Problem ... 181
Fastings, Long, and Starvation. C. Richet ... 538
Fernald, Frederik A. Concerning Shrews* ... 663
" Politics and Farm-Mortgages. (Corr.) ... 843

PAGE
Fielde, Miss Adele M. The Chinese Theory of Evolution* 397
Films, The Laws of.* Mrs. S. B. Herrick 620
Fishes, Deep-Sea. (Misc.) 135
Flames, Sensitive, and Sound-Shadows.* W. Le Conte Stevens 36
Flour-making in the Northwest. (Misc.) 570
Fogs, London, Composition of. (Misc.) 282
Forestry Association, The American. (Misc.) 423
Fossils, Interesting, of British North America. (Misc.) 424
Friction, If there were no. (Misc.) 135
Fuegians and Patagonians, Darwin on the* 744

Gem Minerals of Canada. (Misc.) 862
Germination, Experiments in. (Misc.) 288
Giffen, Robert. The Gross and Net Gain of Rising Wages 649
Glaisher, James, Sketch of. (With Portrait) 546
Glass-Making. III. The Evolution of a Glass Bottle.* C. H. Henderson 154
Governmental Aid to Injustice. G. M. Wallace 191
Greenland, The Ice-Cap of. (Misc.) 277
Greenwood, Frederick. Letters on the Land Question 334, 507
Gulf Stream, The Fate of the. (Misc.) 133

Harvest, A, from the Ocean. C. M. Strahan 377
Health Resorts, British, Climates of. (Misc.) 141
Henderson, C. Hanford. A Chemical Prologue 668
" Glass-Making. III. The Evolution of a Glass Bottle* 154
Henry, Stuart O. Rainfall on "The Plains" 535
Herbert, Auberon. Letters on the Land Question 507
Herrick, Mrs. Sophie Bledsoe. Sketch of A. J. F. Plateau. (With Portrait). 693
" The Laws of Films* 620
Hilber, Vinzenz. The Struggle of Sea and Land 222
Himalayan Vegetation, Stages of. (Misc.) 428
History in High and Preparatory Schools. (Misc.) 276
Horse-flesh, Distinctive Characteristics of. (Misc.) 141
Houzeau, J. C. The Meaning of Pictured Spheres 688
Human Body, Is the, a Storage-Battery? Hyland C. Kirk 76
Human Body, Why not "Cobble up" the? John McElroy. (Corr.) 120
Huron and Iroquois Burials. (Misc.) 717
Huxley, Thomas Henry. Letters on the Land Question 334, 507
" On the Natural Inequality of Men 761

Iles, George. Two and a Half per Cent 349
Incendiaries, A Classification of. (Misc.) 284
Individualism. (Editor's Table) 557
Inequality, On the Natural, of Men. T. H. Huxley 761
Inheritance of Acquired Habit. (Misc.) 142
Insanity, The Test of. L. A. Tourtellot. (Corr.) 554
Intelligence of Squirrels. T. W. Mills 839
Irish Holiday Customs. (Misc.) 858
Iron, The Office of, in the Blood. (Misc.) 286

PAGE
Irrigation of Arid Lands. H. J. Philpott..... 364
Israelite and Indian. Garrick Mallery..... 52, 193

Jameson, Charles D. The Evolution of the Modern Railway Bridge*..... 461
Jastrow, Joseph. A Correction. (Corr.)..... 409
Jordan, David Starr. Science in the High School..... 721

Kansas, The Salt Product of. (Corr.) J. G. Wood..... 845
Kirk, Hyland C. Is the Human Body a Storage-Battery?..... 76
Knowledge, How to make, Real. (Editor's Table)..... 701
Koch, Robert, Sketch of. (With Portrait)..... 259
Kola-nut, Properties of the. (Misc.)..... 862

Lagrange, Fernand. Exercise for Chest Development..... 522
Laidler, John. Letters on the Land Question..... 334
Lake Ridges of Ohio. (Misc.)..... 423
Land-Ownership, Origin of. D. E. Wing..... 644
Land Question, Letters on the. Herbert Spencer, F. Greenwood, T. H. Huxley, Louis Mallet, and John Laidler..... 334
" " T. H. Huxley, Herbert Spencer, A. Herbert, F. Greenwood, and D. Wilson..... 507
Land Question, The. (Editor's Table)..... 411
Land Tenures in China. (Misc.)..... 860
Laporte, Victor. Suspension of Vitality in Animals..... 257
Le Conte, John, Sketch of. (With Portrait). W. Le Conte Stevens..... 112
Leprosy, A Discussion about. (Misc.)..... 137
Light, Standards of. (Misc.)..... 136
Lindenthal, Gustav. Rigidity of the Suspension Bridge. (Corr.)..... 844
Localization of Industries, The. J. J. Menzies..... 454
Lucayan Indians, The.* W. K. Brooks..... 88
" A. B. Ellis. (Corr.)..... 701

M., A. A. A Defense of "Advanced" Women. (Corr.)..... 699
McElroy, John. Why not "Cobble up" the Human Body? (Corr.)..... 120
Mackenzie, Morell. Speech and Song. I. Speech..... 99
" " II. Song..... 242
Maindron, Maurice. Dragons, Fabled and Real.*..... 808
Mallery, Garrick. Israelite and Indian..... 52, 193
Mallet, Louis. Letters on the Land Question..... 334
Mammoth Cave, The Great Hall of the. (Misc.)..... 575
Maori Axe, The Sacred. (Misc.)..... 426
Marriage, Disparity in. (Misc.)..... 140
Measures, Ancient Chaldean and Modern. (Misc.)..... 279
Mechanical Work, Experience and Training in. (Misc.)..... 280
Men, Classes of. (Misc.)..... 139
Mental Bias of Witnesses, The. Helen A. Clarke. (Corr.)..... 120
Mental Torpor Remedy, The. (Misc.)..... 427
Menzies, J. J. The Localization of Industries..... 454
Mercer, John, F. R. S. (Misc.)..... 136
Meredith, E. P. Moral Instruction in our Public Schools. (Corr.)..... 843

PAGE
Meteorite Swarms, The Moving Forces of. (Misc.) 425
Meyer, Otto. Birds with Teeth.* 382
Mills, T. Wesley. Intelligence of Squirrels 829
Mining, Ancient Aboriginal. (Misc.) 131
Minnesota, An Unsettled Part of. (Misc.) 276
Minority, A, but not a Sect. (Editor's Table) 122
Moral Instruction in our Public Schools. (Corr.) E. P. Meredith 843
Mound-Builders and Indians. (Misc.) 283
Mounds, Aboriginal, in Manitoba. (Misc.) 571
Mount Roraima. (Misc.) 279
Music, What it takes to play a Piece of. (Misc.) 278

Northern Lights. W. Stosz 801
Notes 143, 286, 429, 575, 718, 863

Obituary Notes 288, 432, 720, 864
Orchids, The Rare Forms of.* J. Dybowski 359
Ousley, Clarence N. A Lesson in Co-operation 821

Packard, A. S. The Effect of Cave Life on Animals 389
Paleolithic Man in America, The Descendants of. Charles C. Abbott 145
Palm-Oil. (Misc.) 429
Palm-Trees and their Uses.* J. Poisson 371
Panama Canal Projects, Old. (Misc.) 859
Paros, The Island of, and its Marbles. (Misc.) 284
Pascagoula, The Mysterious Music of. C. E. Chidsey 791
Patriarchal Estate, A. (Misc.) 142
Patrick, G. T. W. The Psychology of Prejudice 633
Peple, Charles A. Environment and the Reproductive Power of Animals. (Corr.) 409
Perfumes, Flowers and. (Misc.) 430
Philpott, Henry J. A Novel Water-Cooler. (Corr.) 700
" Irrigation of Arid Lands 864
Phthisis, Climate and. (Misc.) 138
Physiognomy, The, of the Mouth.* Th. Piderit 678
Piderit, Th. The Physiognomy of the Mouth.* 678
Plain Words on the Woman Question. Grant Allen 170
Plateau, A. F. J., Sketch of. (With Portrait.) Mrs. S. B. Herrick 693
Poisson, J. Palm-Trees and their Uses* 371
Political Economy. (Editor's Table) 845
Politics and Farm Mortgages. (Corr.) F. A. Fernald 843
Precious Stones in the United States. (Misc.) 715
Prejudice, the Psychology of. G. T. W. Patrick 633
Property, The Right to. John H. Wigmore. (Corr.) 121
Prunes. (Misc.) 137
Public Schools and Crime. C. S. Davis. (Corr.) 700
Public Schools as affecting Crime and Vice. B. Reece 319
Publications received 130, 275, 422, 569, 713, 857

"Rabbit Pest," The, in Australia. (Misc.) 132
Racial Developments, A Comparison in. (Editor's Table) 265

PAGE
Rainfall on "The Plains." S. O. Henry..... 535
Reece, Benjamin. Public Schools as affecting Crime and Vice..... 319
Refrigeration by Ammonia. (Misc.)..... 860
Remonstrance, A. H. W. (Corr.)..... 408
Reproductive Power in Animals, Conditions affecting the. James H. Stoller.. 48
Reproductive Power of Animals, Environment and the. C. A. Peple. (Corr.). 409
Responsibility in Mental Disease. James Crichton-Browne..... 81
Richet, Charles. Long Fastings and Starvation..... 538
Rittenhouse, David, Sketch of. (With Portrait)..... 835
Rochas, A. De. Alchemist's Gold..... 814
Rotifera, Distribution of. (Misc.)..... 281
Royal Society, The, of England. W. C. Cahall..... 226

Science in Domestic Economy. (Editor's Table)..... 123
Science in the High School. D. S. Jordan..... 721
Sea and Land, The Struggle of. V. Hilber..... 222
Shrews, Concerning.* F. A. Fernald..... 663
Silurian, The Name, in Geology. J. D. Dana. (Misc.)..... 276
Sleeplessness, Remedies for. (Misc.)..... 426
Sliding Railway, The. (Misc.)..... 862
Sloyd: its Aim, Method, and Results.* F. B. Arngrimsson..... 784
Slums, The Human Factor in. (Misc.)..... 142
Snow-Blindness. (Misc.)..... 575
Socialists, A Fallacy of the. J. L. Taylor. (Corr.)..... 699
Sound-Shadows, Sensitive Flames and.* W. Le Conte Stevens..... 36
Speech and Song. Morell Mackenzie. I. Speech..... 99
" " II. Song..... 242
Spencer, Herbert. Absolute Political Ethics..... 608
" Letters on the Land Question..... 334, 507
Spheres, Pictured, The Meaning of. J. C. Houzeau..... 688
Spiders, Mental Powers of. (Misc.)..... 141
Spiders' Webs, Raining. (Misc.)..... 863
Spirits, Evil, A Chase of. (Misc.)..... 137
Spirits, The Indwelling, of Men. A. B. Ellis..... 794
Stevens, W. Le Conte. Sensitive Flames and Sound-Shadows*..... 36
" Sketch of John Le Conte. (With Portrait)..... 112
Stoker's Life, A. (Misc.)..... 140
Stoller, James H. Conditions affecting the Reproductive Power in Animals. 48
Stone Implements, How, were made. (Misc.)..... 280
Storage-Battery, Is the Human Body a? Hyland C. Kirk..... 76
Stosz, Wilhelm. Northern Lights..... 801
Strahan, C. Morton. A Harvest from the Ocean..... 377
Suspension Bridge, Rigidity of the. (Corr.) G. Lindenthal..... 844
Suspension of Vitality in Animals. V. Laporte..... 257

Tahl-tan Indians, The, of British Columbia. (Misc.)..... 860
Taouist Religion, The. W. G. Benton..... 329
Tapestries. (Misc.)..... 571
Tapioca. (Misc.)..... 284
Taylor, James L. A Fallacy of the Socialists. (Corr.)..... 699

PAGE
Tcheng-Ki-Tong. Chinese Silk-Lore* 500
Telescope, The Bruce Photographic. (Misc.) 278
Thurston, John R. Farming and the Tariff. (Corr.) 408
Ties, Iron Railway. (Misc.) 286
Tolstoi's Confession. (Editor's Table) 410
Toronto, The Disaster at. (Misc.) 858
Tourtellot, L. A. The Test of Insanity. (Corr.) 554
Toy, Crawford Howell. Ethics and Religion 727
Triassic History, A Bit of. (Misc.) 573
Trinity House, Favoritism at. (Misc.) 424
True, M. B. C. Decadence of Farming in England. (Corr.) 553
Truth, The Recognition of. (Editor's Table) 703
Tweedy, Miss Alice B. Is Education opposed to Motherhood? 751
Two and a Half per Cent. G. Iles 349

Unfounded Statement, An. (Editor's Table) 847
Unhealthiness, Causes of, in Large Cities. (Misc.) 716
Uranium. (Misc.) 573
Useful Ignorance. (Editor's Table) 555

W., H. A Remonstrance. (Corr.) 408
Wages, Rising, The Gross and Net Gain of. R. Giffen 649
Wallace, George M. Governmental Aid to Injustice 191
Waller, Mrs. Jessie O. Mental and Physical Training of Children 213
Warfare of Science, New Chapters in the. VII. Comparative Mythology. A. D. White 433, 577
Water-Cooler, A Novel. H. J. Philpott. (Corr.) 700
Water, Iron as a Purifier of. (Misc.) 573
Weather Service, The Future of our. (Misc.) 714
Whales, British. (Misc.) 136
White, Andrew Dickson. New Chapters in the Warfare of Science. VII. Comparative Mythology 433, 577
White, Horace. Agriculture and the Single Tax 481
Wigmore, John H. The Right to Property. (Corr.) 121
Wilson, Alexander, Sketch of. (With Portrait) 400
Wilson, Darcy, Letters on the Land Question 507
Wing, Daniel E. Origin of Land-Ownership 644
Witch-Stories, Italian. (Misc.) 139
Woman Question, Grant Allen on the. Miss E. F. Andrews. (Corr.) 552
Woman Question, Plain Words on the. Grant Allen 170
Women, "Advanced," A Defense of. A. A. M. (Corr.) 699
Women, Educated, The Mission of. Mrs. M. F. Armstrong 601
Wood, J. G. The Salt Product of Kansas 845
Woodcock, How the, feeds. (Misc.) 717

Yellowstone Park, Geological History of. (Misc.) 282

Zoölogy, Old and New Methods in. H. de Lacaze Duthiers 19

END OF VOL. XXXVI.

Cluett's

COLLARS AND CUFFS,

FOR GENTLEMEN.

Cluett, Coon & Co.

MANUFACTURERS,

TROY, N. Y.

MONARCH SHIRTS

IN

FLANNEL, MADRAS, AND CHEVIOT.

Sold by Leading Dealers.

JOSEPH GILLOTT'S STEEL PENS.

Sold by all Dealers throughout the World!

Gold Medal, Paris Exposition, 1878.

For Fine Writing, No. 1, 303, *and Ladies,* **170. For Broad Writing, 294, 389,** *and stub point,* **849. For General Writing, 332, 404, 390,** *and Falcon,* **878, 908.** *Other styles to suit all hands.*

☞ *Sample Cards, Price-lists, etc., furnished on application.*

JOSEPH GILLOTT & SONS, 91 John St., New York. HENRY HOE, Sole Agent.

MACMILLAN & CO.'S NEW SCIENTIFIC BOOKS.

Translations of Foreign Biological Memoirs. New Volumes.

THE ANATOMY OF THE FROG. By Dr. Alexander Ecker, Professor in the University of Freiburg. Translated, with numerous Annotations and Additions, by George Haslam, M. D., and profusely illustrated with 250 Wood Engravings and 11 Colored Figures. Medium 8vo. $5.25.

WEISMANN ON HEREDITY.

ESSAYS UPON HEREDITY AND KINDRED BIOLOGICAL PROBLEMS. By Dr. August Weismann. Translated by E. B. Poulton, M. A., F. L. S., Selmar Schönland, Ph. D., and A. E. Shipley, M. A., F. L. S. 8vo. $4.00.

Student's Edition, abridged from the larger work.

ABSOLUTE MEASUREMENTS IN ELECTRICITY AND MAGNETISM. By Andrew Gray, M. A., F. R. S. E., Professor of Physics in the University College of North Wales. Second edition. Revised and greatly enlarged. 16mo. $1.25.

"About a year ago the first volume of what is designed to be a comprehensive treatise on this subject was published by Messrs. Macmillan & Co., under the title of 'The Theory and Practice of Absolute Measurements in Electricity and Magnetism,' and the second volume is now in progress. It has, however, been represented to me that a smaller work would be found useful to students. I have therefore prepared the present volume."—*From the Preface.*

"The present work is well designed for supplying this acknowledged want, and will, we believe, be welcomed by students and teachers."—*Manchester Guardian.*

Nature Series. New volume.

MODERN VIEWS OF ELECTRICITY. By Oliver J. Lodge, D. Sc., LL. D., F. R. S. With Illustrations. 12mo. $2.00.

"So far as electricity is concerned, this is *the* book of the year. The object of this book is to present to the non-mathematical reader the modern view of the ethereal theory of electricity. To our mind there is no living exponent of these theoretical views so able as the author of this book. He writes from conviction, with a thorough knowledge of his subject, and goes straight to the point without superfluity of language."—*Electrical Engineer.*

HANDBOOK OF PRACTICAL BOTANY. For the Botanical Laboratory and Private Student. By E. Strasburger, Professor of Botany in the University of Bonn. Edited from the German by W. Hillhouse, M. A., F. L. S. Revised by the author, and with many additional notes by author and editor. Second edition, revised and enlarged. With 116 original and 33 additional Illustrations. 8vo. $2.50.

Part II, now ready, completing the work.

ALGEBRA. An Elementary Text-Book for the Higher Classes of Secondary Schools and for Colleges. By G. Chrystal, M. A., LL. D. 8vo. Part II, $4.00. Recently published, Part I, $3.75. The two volumes, $7.50.

WALLACE'S DARWINISM.

DARWINISM. An Exposition of the Theory of Natural Selection, with some of its Applications. By Alfred Russel Wallace, LL. D., F. L. S., author of "The Malay Archipelago," etc. With Map, Portrait, and Illustrations. 12mo. $1.75.

"The present work contains the conclusions upon this great subject of thirty years of thought and observation. . . . A contribution of the first importance to the literature of the subject. At the same time it would be difficult to find a book more entertaining to the general reader. He writes with the sincerity and easy mastery which comes of fullness of knowledge. There can be no more interesting guide in that great wonderland of science in which he has been so long one of the chief discoverers."—*New York Times.*

Just published, Vol. II, completing Dr. McKendrick's Work on Physiology.

A TEXT-BOOK OF PHYSIOLOGY. By John Gray McKendrick, M. D., LL. D., F. R. S. Including Histology, by Philipp Stöhr. In two volumes.

Vol. I. General Physiology. Including the Chemistry and Histology of the Tissues and the Physiology of Muscle. 8vo. $4.00.

Vol. II. Special Physiology. Including Nutrition, Innervation, and Reproduction. 8vo. $4.00.

New Volume (Part II), just published.

A TEXT-BOOK OF PHYSIOLOGY. By Michael Foster, M. A., M. D., LL. D., F. R. S. With Illustrations. Fifth edition, largely revised.

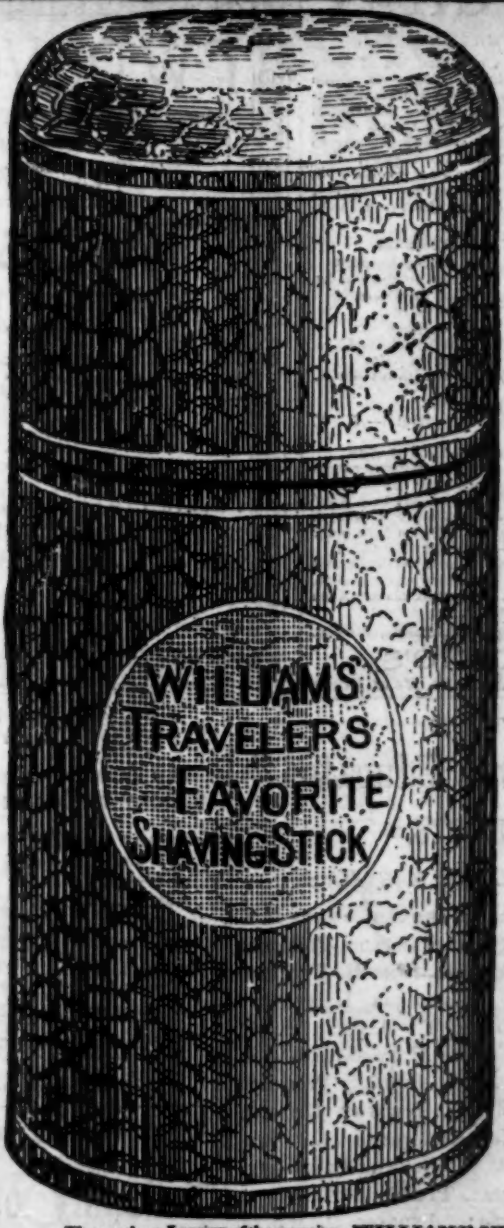
Part I. Comprising Book I. Blood—The Tissues of Movement—The Vascular Mechanism. 8vo. $2.60.

Part II. Comprising Book II. The Tissues of Chemical Action, with their Respective Mechanisms—Nutrition. 8vo. $2.60.

"It is in all respects an ideal text-book. It is only the physiologist, who has devoted time to the study of some branch of the great science, who can read between the lines of this wonderfully generalized account, and can see upon what an intimate and extensive knowledge these generalizations are founded. It is only the teacher who can appreciate the judicious balancing of evidence and the power of presenting the conclusions in such clear and lucid forms. But by every one the rare modesty of the author, in keeping the element of self so entirely in the background, must be appreciated. Reviewing this volume as a whole, we are justified in saying that it is the only thoroughly good text-book of physiology in the English language, and that it is probably the best text-book in any language."—*Edinburgh Medical Journal.*

Macmillan & Co.'s complete catalogue of publications will be sent free by mail to any address on application.

MACMILLAN & CO., 112 Fourth Avenue, New York.



Do You Shave Yourself?

—Then make a **Luxury** of the exercise. **WILLIAMS' SHAVING STICK** offers the means of doing so. Soft, delicate, cream-like lather! Exquisitely scented with the most delicate **ATTAR OF ROSES.** The new case is a beauty. Strong, durable. Never breaks, ends never come out. Travel a million miles with it—always intact. Rich maroon leatherette cover, gold lacquered metal inside. ASK YOUR DRUGGIST for it **AT ONCE.** It cost *no more* than others.

☞ If your Druggist does not have WILLIAMS' SHAVING STICK, we will mail you one neatly packed, postage paid, for 25c. in stamps. One WILLIAMS' SHAVING STICK is enough for 250 shaves. 10 comfortable, refreshing shaves for ONE CENT. TRY IT.

Address **THE J. B. WILLIAMS CO., Glastonbury, Conn.,**

Established half a hundred years. Makers of the famous GENUINE YANKEE SHAVING SOAP.

BOOK CHAT.

Novel, Bright, and Original.

It gives each month a classified list of *every article* on *every subject* in the magazines of the world—American, English, French, German, Spanish, and Italian. This will be found of incalculable value to persons interested *in any special course of reading or studies*, or those merely wishing to keep up to the times on questions of the day.

In a half-dozen lines is given an outline of each book of the month, showing something of its plot, object, etc., telling what a book is about rather than criticising it.

Fifteen Bright Departments.

New Books,	Magazine Leaders,
Gossip about Authors,	Some Notable Books,
Selected Current Readings,	With the Poets,
Coming Books,	New Serials,
Magazine Briefs,	Open Questions,
Without Comment,	Novel Editorials,
Classified Lists,	Fugitive Essays.

Latest French, German, Spanish, and Italian Books.

PRESS COMMENTS.

"Comprehensive and well edited."—*N. Y. Graphic.*

"A perfect gem in its way."—*Troy Budget.*

"The field which this sprightly monthly covers is one that heretofore has been left unoccupied. While it gossips it is never trivial, but in a brief paragraph or a few words oftimes conveys as much practical meaning as the longer criticism of its older literary contemporaries."—*Brooklyn Magazine.*

"Represents an herculean amount of labor, and it is labor so well directed that every stroke is sure, every touch a happy one. Its editorials are keen and novel."—*Boston Traveller.*

$1.00 per year; single numbers, 10 cts.

BRENTANO'S,

5 Union Square, New York.

F·W·DEVOE·&·CO.

ESTABLISHED 1852

OFFICES: COR. FULTON & WILLIAM STS.

NEW YORK.

ARTISTS' MATERIALS.

SKETCHING OUTFITS OF ALL KINDS

TUBE COLORS · WATER COLORS · CRAYONS

DRAWING PAPER · CANVAS · BRUSHES · OILS & MEDIUMS ·

MATHEMATICAL INSTRUMENTS

HOUSE PAINTERS' COLORS

FRESCO COLORS · FINE VARNISHES

Correspondence invited · Catalogues of our different departments to responsible parties.

COFFIN·DEVOE & CO·176 RANDOLPH ST·CHICAGO

THE

"How I was Educated" Papers.

From the FORUM MAGAZINE.

By EDWARD E. HALE; THOMAS WENTWORTH HIGGINSON; F. A. P. BARNARD, President of Columbia College; JOHN H. VINCENT, Chancellor of Chautauqua University; Professor WILLIAM T. HARRIS; S. C. BARTLETT, President of Dartmouth College; J. R. KENDRICK, formerly President of Vassar College; TIMOTHY DWIGHT, President of Yale College; E. G. ROBINSON, President of Brown University; JAMES B. ANGELL, President of University of Michigan; ANDREW D. WHITE, formerly President of Cornell University.

8vo, paper cover. Price, 30 cents.

In response to numerous requests, largely from teachers and others interested in education, the series of papers above designated, which formed the first part of the volume "The College and the Church," recently published, is here presented in a popular form at a low price.

D. APPLETON & CO., PUBLISHERS, NEW YORK.

QUITE WELCOME

to a copy of our little book "HOW TO MAKE PHOTOGRAPHS."

Your name and address is all sufficient to receive a copy of this book containing an illustrated catalogue of our photographic goods.

Our stock is varied and complete. Outfits cost from $2.50 upward.

The Scovill & Adams Co.,

423 Broome St., New York.

APPLETONS'

Dictionary of New York.

A guide to all places, information upon all local subjects, alphabetically arranged.

With Illustrations and excellent Maps.

PRICE, 30 CENTS; AT ALL BOOKSTORES.

D. APPLETON & CO., PUBLISHERS,

1, 3, & 5 Bond Street, New York.

Free for Four Weeks!

Twentieth Century,

A Weekly Magazine.

HUGH O. PENTECOST, *Editor.* T. L. M'CREADY, *Associate Editor.*

Each number contains Mr. Pentecost's Lecture of the preceding Sunday, delivered in Newark, Brooklyn and New York.

MOTTO: "HEAR THE OTHER SIDE."

This Magazine advocates Personal Sovereignty in place of State Sovereignty, Voluntary Coöperation instead of Compulsory Coöperation, the Liberation of the human mind from Superstition, and the application of the principles of Ethics toward Social Regeneration.

It is meant to be a broad-minded, unsectarian meeting place for the representatives of all schools of Religious and Economic thought. Orthodox and Liberal Christians, Spiritualists, Hebrews, Agnostics, and Secularists of every shade of opinion; Protectionists, Freetraders, Single-taxers, Nationalists, Socialists and Anarchists, advocates of peaceful measures of social regeneration and revolutionists, will all be welcomed to its columns with equal cordiality, fairness and respect. As an indication of the broad scope of the magazine here are the names of

Some Contributors:

Edward Bellamy, author of "Looking Backward."
Rev. John W. Chadwick, author of "The Faith of Reason," "The Bible of To-day," etc.
Rev. W. S. Crowe, editor of the "Universalist Record."
Clinton Furbish, editor of "The Leader," (Chicago).
Rev. Henry Frank, Independent Church, Jamestown, N. Y.
Rabbi G. Gottheil, of the Temple Emanu El, Fifth avenue, New York City.
Helen H. Gardener, author of "Men, Women and Gods."
Laurence Gronlund, author of "Coöperative Commonwealth."
J. K. Ingalls, author of "Social Wealth."
Rev. John C. Kimball, Radical Unitarian.
Harry L. Koopman, Librarian University of Vermont.
Dr. Daniel DeLeon, late Professor of International Law, Columbia College.
Dyer D. Lum, author of "Concise History of the Chicago Anarchists," etc.
Marie Louise, Philosophical Anarchist.
Rev. R. Heber Newton, Episcopalian; author of "Right and Wrong Uses of the Bible."
Edmund Montgomery, author of many scientific treatises in German and in English.
Hon. Frank T. Reid, Single-Taxer.
Prof. William G. Sumner, author of "What the Social Classes Owe to Each Other," and Professor of Political Economy in Yale College.
Wm. M. Salter, Lecturer of the Society for Ethical Culture of Chicago; author of "Ethical Religion."
W. L. Sheldon, Lecturer of the Society for Ethical Culture of St. Louis.
Sergius G. Shevitch, editor of "The New York Volks Zeitung."
Gen. M. M. Trumbull, author of "Life of Thomas Jefferson."
Benj. R. Tucker, editor of "Liberty," (Boston).
T. B. Wakeman, Positivist and Socialist; author of "Classification of the Sciences," etc.
Rev. J. M. Whiton, Ph. D., Congregationalist; author of a number of works.
James H. West, author of "Uplifts of the Heart and Will," etc., and editor of the "New Ideal," (Boston).
Otto Wettstein, Atheist and Materialist.
A. Van Deusen. J. W. Sullivan. Victor Yarros.

An economic symposium by thinkers of national and international reputation, will soon begin in our columns; to be followed by a symposium on the ferment in religion, by the leaders in that line of thought.

PUBLISHED WEEKLY, 24 PAGES.
Subscriptions:—One Year, $2; Six Months, $1; Three Months, 60 Cents.

Free for Four Weeks to all Applicants.

☞ This free trial offer will remain open during the next two months. Do you wish to know the grievances of the discontented classes? Do you wish to know their suggestions of a remedy? Do you wish to read the most courageous, radical and reform magazine of modern times,—even though you may disagree with it in toto? Then send a postal card with your address to

Twentieth Century,
4 WARREN STREET, NEW YORK CITY.

THE STRUCTURE AND DISTRIBUTION OF CORAL REEFS.

By CHARLES DARWIN.

With Notes, and an Appendix giving a Summary of the Principal Contributions to the History of Coral Reefs since the Year 1874, by Prof. T. G. Bonney.

FROM THE THIRD ENGLISH EDITION, JUST PUBLISHED.

With Charts and Illustrations. **12mo, cloth. Price, $2.00.**

The publishers have taken the occasion of a new English edition of this work to offer the first American edition, which is made specially valuable by the important additions by Prof. Bonney.

"Since 1874, when Darwin, that prince of natural observers, revised and published his 'Coral Reefs' in a second edition, the progress of our knowledge of the distribution of the coral insect and the conditions of the formation of coral islands, reefs, etc., has proved that the observations and conclusions published by him fifteen years ago are essentially true. Criticism of, and opposition to, his theory, which has since that time been the generally accepted one among biologists and geologists, have occasionally appeared, and many new facts have been contributed which throw new light on the details and less known aspects of coral formations. In bringing out a third edition it was thought best to allow the body of the edition of 1874 to remain intact, supplementing it with a review of the discoveries and opinions set forth by various authors since the publication of the second edition. Prof. T. G. Bonney, the eminent petrographer, who was chosen to undertake the latter work, has ably performed the task, and he has done it in a manner as candid and philosophical as Darwin's."—*The Epoch.*

New York: D. APPLETON & CO., 1, 3, & 5 Bond Street.

DR. WM. A. HAMMOND'S SANITARIUM

FOR DISEASES OF THE NERVOUS SYSTEM, Washington, D. C.

DR. WILLIAM A. HAMMOND announces to the medical profession that he has returned from New York to Washington, D. C., where he has established, in a building especially erected for the purpose, a *Sanitarium* for the treatment of mild and curable cases of mental derangement, diseases of the nervous system generally, cases of the morphia and chloral habits, and such other affections as may properly be treated by the remedial agencies under his control.

The *Sanitarium* is situated on Columbia Heights, at the corner of Fourteenth Street and Sheridan Avenue. The position is the highest in the immediate vicinity of Washington, the soil is dry, and all the surroundings are free from noxious influences. Electricity in all its forms, baths, douches, massage, inhalations, nursing, etc., are provided as may be required by patients, in addition to such other medical treatment as may be deemed advisable.

A large *Solarium*, for sun-baths and exercise in cold or inclement weather, and heated with steam in winter, is constructed on the top of the main building.

The *Sanitarium* has now been in successful operation since the 7th of January, 1880.

For further information Dr. Hammond can be addressed at The Sanitarium, Fourteenth Street and Sheridan Avenue, Washington, D. C.

THE NEW STANLEY BOOK.

HEROES OF THE DARK CONTINENT,

AND

HOW STANLEY FOUND EMIN PASHA.

A COMPLETE HISTORY OF ALL THE GREAT EPXLORERS AND DISCOVERERS IN AFRICA, FROM THE EARLIEST AGES TO THE PRESENT TIME, INCLUDING A FULL, AUTHENTIC, AND THRILLING ACCOUNT OF

Stanley's Famous Relief of Emin Pasha.

Replete with Astounding Incidents, Wonderful Adventures, Mysterious Providences, Grand Achievements, and Glorious Deeds, as Represented in the Devoted Lives and Splendid Careers of such Brilliant Characters as

HENRY M. STANLEY, EMIN PASHA, GEN. (Chinese) GORDON,

And all the other Great Travelers, Hunters, and Explorers, who, for More Than One Thousand Years, have made Africa a Land of Wonders by their Heroism and Unparalleled Daring.

COVERING THE WHOLE HISTORY OF AFRICAN EXPLORATION AND DISCOVERY.

Enlivened with Stories of Marvelous Hunts and Wonderful Adventures among the Wild Animals, Ferocious Reptiles, and the Curious and Savage Races of People who inhabit the Dark Continent.

By J. W. BUEL,

The famous author of "The Beautiful Story," "The Living World," "The Story of Man," "Sea and Land," "The World's Wonders," "Exile Life in Siberia," etc.

Illustrated with nearly 500 of the Grandest, Most Beautiful, and Wonderful Engravings, and Magnificent Colored Plates.

NOW IS THE TIME FOR AGENTS TO CANVASS.

The outfit will be ready in a few days. Send for our elegant descriptive circulars and terms.

HUNT & EATON,

Fifth Avenue and Twentieth Street, New York.

"I consider THE FORUM as furnishing the most intelligent and sympathetic audience that a thoughtful writer can find to address in any land."

Prof. ALEXANDER WINCHELL, of the University of Michigan.

EVERY article that appears in THE FORUM is written especially for its pages, and appears nowhere else, except in books republished from THE FORUM.

The Forum:

A Monthly Review of Living Subjects by the Foremost Writers.

THE FORUM is independent financially; it is independent also of any sect, or party, or "interest" of any sort whatever; and the sole business of THE FORUM PUBLISHING COMPANY is to make the most helpful periodical possible to thoughtful readers.

"THE career of THE FORUM has been a continued success, the result of judicious management and a recognition of the needs of thoughtful and intelligent readers. It has never given place to a sensational article. . . . It has never departed from the high literary and moral standard which characterized its beginning."

Boston Evening Transcript, September 30, 1889.

LAST year more than three thousand editorial articles, based on the contents of THE FORUM, were published in the American and English papers. In one week, in October, 1889, fourteen of the leading daily papers of the United States, including one or more in every important city from Boston to St. Louis, contained leading editorials on articles in a single number of THE FORUM.

The following order will be honored if signed by any subscriber to *The Popular Science Monthly*. *The Popular Science Monthly* and THE FORUM will be sent one year for $9.00.

The Forum Publishing Company will please mail the Forum to my address for one year, beginning with the number for the month of _____ 18__ and send bill for five dollars.

The price of THE FORUM is $5.00 a year. No reduction is made to any class of subscribers.

THE FORUM PUBLISHING COMPANY,
253 FIFTH AVENUE, NEW YORK.

1890.

ECLECTIC MAGAZINE

— OF —

Foreign Literature, Science, and Art.

46th YEAR.

The Foreign Magazines embody the best thoughts of the ablest writers of Europe. It is the aim of the ECLECTIC MAGAZINE to select and reprint these articles. The plan of the ECLECTIC includes *Science, Essays, Reviews, Biographical Sketches, Historical Papers, Art Criticism, Travels, Poetry, and Short Stories, from*

THE ABLEST WRITERS IN THE WORLD.

The following are the names of some of the leading authors whose articles appear in the pages of the ECLECTIC.

AUTHORS.

Rt. Hon. W. E. GLADSTONE,	E. A. FREEMAN, D. C. L.,
ALFRED TENNYSON,	JAMES ANTHONY FROUDE,
Prof. HUXLEY,	THOMAS HUGHES,
Prof. TYNDALL,	ALGERNON C. SWINBURNE,
W. H. MALLOCK,	WILLIAM BLACK,
J. NORMAN LOCKYER, F. R. S.,	Mrs. OLIPHANT,
Dr. W. B. CARPENTER,	Cardinal NEWMAN,
E. B. TYLOR,	Cardinal MANNING,
Prof. MAX MÜLLER,	Miss THACKERAY,
Prof. OWEN,	THOMAS HARDY,
HENRY TAINE,	ROBERT BUCHANAN,

etc., etc.

The ***Eclectic*** *enables the American reader to keep himself informed on the great questions of the day throughout the world, and no intelligent American can afford to be without it.*

The **Eclectic** comprises each year two large volumes of over 1,700 pages. Each of these volumes contains a **fine steel engraving,** which adds much to the attraction of the magazine.

TERMS: Single copies, 45 cents; one copy, one year, $5; five copies, $20. Trial subscription for three months, $1. The **Eclectic** and any $4 magazine, $8.

E. R. PELTON, Publisher,

25 Bond Street, New York.

ELEVENTH YEAR.

The Canada Educational Monthly.

P. O. BOX 2675.

$1.00 A YEAR.

"THE CANADA EDUCATIONAL MONTHLY is improving with each issue."—*The Canadian Advance*.
"I read THE EDUCATIONAL MONTHLY regularly and like its spirit and its views generally much."
—*A Canadian Professor*.

The Educational Magazine of Canada.

Its Contributors are the First Educationists of the Day.

TEACHERS CAN NOT INVEST A DOLLAR WITH MORE PROFIT THAN BY BECOMING SUBSCRIBERS.

A Magazine that Every Teacher Should Take.

"The SANITARIAN

Is THE BEST Sanitary publication in America" (*Mississippi Valley Medical Monthly*); "Easily maintains its superiority over all similar publications" (*Medical World*); and "Has accomplished more good than all of the other Sanitary papers put together" (*Hydraulic and Sanitary Plumber*). "The *Editor*, Dr. A. N. BELL, is well known to the mercantile community for his co-operation with the merchants in quarantine reform, and to his profession as a leader in Sanitary Science" (*N. Y. Journal of Commerce.*)

96 PAGES TEXT MONTHLY; TWO VOLUMES YEARLY.

$4.00 a year, in advance; 35 cents a Number. Sample copies, 20 cents. (Ten two-cent postage-stamps.)

☞ All communications should be addressed to the Editor,

113A SECOND PLACE, BROOKLYN.

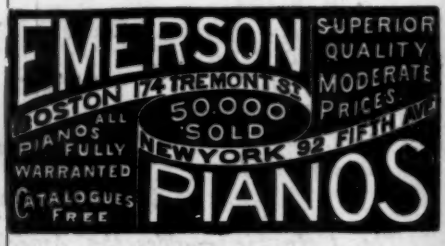
WALNUT LODGE HOSPITAL,

HARTFORD, CONN.

Organized in 1860 for the special medical Treatment of ALCOHOL and OPIUM INEBRIATES.

Elegantly situated in the suburbs of the city, with every appointment and appliance for the treatment of this class of cases, including *Turkish, Russian, Roman, Saline*, and *Medicated Baths*. Each case comes under the direct personal care of the physician. Experience shows that a large proportion of these cases are curable, and all are benefited from the application of exact hygienic and scientific measures. This institution is founded on the well-recognized fact that *Inebriety* is a *disease* and *curable*, and all *these cases* require *rest, change of thought and living;* in the *best surroundings*, together with every means known to science and experience to bring about this result. Applications and all inquiries should be addressed

T. D. CROTHERS, M. D., Supt., Hartford, Conn.



NEW YORK ILLUSTRATED.

A PICTORIAL DELINEATION OF

STREET SCENES, BUILDINGS, RIVER VIEWS,

AND OTHER PICTURESQUE FEATURES OF THE GREAT METROPOLIS.

With Maps. Large 8vo. Illustrated cover. Price, 50 cents.

New York: D. APPLETON & CO., Publishers, 1, 3, & 5 Bond Street.

The Handsomest Photographic Journal in the World.

A PICTURE PERIODICAL, WITHOUT LETTERPRESS.

PUBLISHED MONTHLY.

Each issue of "SUN AND SHADE" consists of eight to twelve plates on paper 11 x 14 inches.

SUBSCRIPTION PRICE, $4.00. SINGLE OR SAMPLE COPIES, 40 CENTS.

A few copies of Nos. 1, 2, and 3 remain, price, 60 cents each. Also, a few, No. 4 (Xmas), $1.00.

What the Press says of "SUN AND SHADE."

"Charming reproductions in most delicate colors of several noted pictures."—*World*, New York.

"A superb new photographic journal. . . . The first number is a sumptuous affair in its mechanical and artistic features."—*Daily Graphic*, New York.

"Splendid pictorial material. It gives photographic reproduction most efficient exposition."—*Philadelphia Photographer.*

"At the same time most truthful and artistic copies from nature and from art."—*Photo. Times*, New York.

"The value and popularity of American illustration have been proved so efficiently that a picture paper, composed only of illustrations, seems a natural outcome of the modern love for pictures. Many interesting subjects make a gallery of timely art."—*Journal*, Boston.

"Examples of the wonderful perfection the art of photographic reproduction has attained. . . . Show a remarkable advance, and demonstrate that America is well able to hold its own against even such artists as Goupil and Braun."—*Ledger*, Philadelphia.

"If the standard of the first number is sustained, the new venture will deserve encouragement. As examples of the high perfection to which photography and photo-gravure may be brought, they are noteworthy."—*Home Journal*, New York.

"A notable magazine. . . . Pleasingly and diversely illustrated."—*Brooklyn Eagle.*

"The facilities afforded by photography have placed within our reach possibilities entirely beyond the conception of earlier times."—*Building*, New York.

"The subjects of 'Ecce Homo,' 'The Return,' 'Sunshine,' 'From the Land of Sleepy Hollow,' and others, in the August number, each executed in its peculiar style, could hardly be improved upon."—*Popular Science Monthly.*

THE PHOTO-GRAVURE CO., Publishers, 137 West 23d St., New York.

THE PRIMITIVE FAMILY IN ITS ORIGIN AND DEVELOPMENT.

By Professor C. N. STARCKE,

Of the Copenhagen University.

Volume XLV of "THE INTERNATIONAL SCIENTIFIC SERIES." 12mo, cloth. Price, $1.75.

"It has been the task of Prof. Starcke to collate the already large literature on clans, tribes, and families among primitive, early, and savage man, reduce the facts already gathered to something like a system, and sift the evidence in favor of this or that theory. The field for speculations in matters of the relations of the sexes before and after marriage, the connections between parents and children, the evolution of the family, the clan, and the tribe, and with regard to the human group, which we ought to accept as the unit from which the state is evolved, is a field almost without bounds, and subject to strange contradictions."—*New York Times.*

New York: D. APPLETON & CO., Publishers, 1, 3, & 5 Bond Street.

HERBERT SPENCER'S WORKS.

SYNTHETIC PHILOSOPHY.

CONTAINING:

1. *FIRST PRINCIPLES.* 12mo. Cloth, $2.00.

Part I. The Unknowable.
II. Laws of the Knowable.

2. *PRINCIPLES OF BIOLOGY.* 2 volumes, 12mo. Cloth, $4.00.

VOL. I.—Part I. The Data of Biology.
II. The Inductions of Biology.
III. The Evolution of Life.
VOL. II.—Part IV. Morphological Development.
V. Physiological Development.
VI. Laws of Multiplication.

3. *PRINCIPLES OF PSYCHOLOGY.* 2 volumes, 12mo. Cloth, $4.00.

VOL. I.—Part I. Data of Psychology.
II. Inductions of Psychology.
III. General Synthesis.
IV. Special Synthesis.
V. Physical Synthesis.
VOL. II.—Part VI. Special Analysis.
VII. General Analysis.
VIII. Corollaries.
IX. Corollaries.

4. *PRINCIPLES OF SOCIOLOGY.* 12mo.

VOL. I. Cloth, $2.00.—
Part I. The Data of Sociology.
II. The Inductions of Sociology.
III. The Domestic Institutions.
VOL. II. Cloth, $2.00.—
Part IV. Ceremonial Institutions.
V. Political Institutions.
Part VI. Ecclesiastical Institutions. Cloth, $1.25.
Parts VII and VIII. Professional and Industrial Institutions. (*In preparation.*)
VOL. III.—(*In preparation.*)

5. *PRINCIPLES OF MORALITY.* 12mo.

VOL. I.—Part I. The Data of Ethics. $1.25.
Cheap edition, paper, 50 cents.
Part II. (*In preparation.*)
VOL. II.—(*In preparation.*)

New York: D. APPLETON & CO., Publishers, 1, 3, & 5 Bond Street.

HERBERT SPENCER'S WORKS.

MISCELLANEOUS.

EDUCATION: INTELLECTUAL, MORAL, AND PHYSICAL. 12mo. Cloth, $1.25; cheap edition, paper, 50 cents.

THE STUDY OF SOCIOLOGY. 12mo. Cloth, $1.50.

SOCIAL STATICS; OR, THE CONDITIONS ESSENTIAL TO HUMAN HAPPINESS SPECIFIED, AND THE FIRST OF THEM DEVELOPED. With a Notice of the Author. 12mo. Cloth, $2.00.

ILLUSTRATIONS OF UNIVERSAL PROGRESS. 12mo. Cloth, $2.00.

ESSAYS, MORAL, POLITICAL, ÆSTHETIC. 12mo. Cloth, $2.00.

RECENT DISCUSSIONS IN SCIENCE, PHILOSOPHY, AND MORALS. 12mo. Cloth, $2.00.

THE FACTORS OF ORGANIC EVOLUTION. Reprinted, with Additions, from "The Nineteenth Century" and "The Popular Science Monthly." 12mo. Cloth, 75 cents.

PHILOSOPHY OF STYLE. 12mo. Flexible cloth, 50 cents.

HERBERT SPENCER ON THE AMERICANS, AND THE AMERICANS ON HERBERT SPENCER. Being a full report of the "Interview," and the Proceedings at the Farewell Banquet of November 9, 1882. 12mo. Paper, 10 cents.

THE MAN versus THE STATE. Containing "The New Toryism," "The Coming Slavery," "The Sins of Legislators," and "The Great Political Superstition." Reprinted from "The Popular Science Monthly," with a Postscript. Small 8vo. Paper, 30 cents.

New York: D. APPLETON & CO., Publishers, 1, 3, & 5 Bond Street.

THE NEW YORK MEDICAL JOURNAL,

A Weekly Review of Medicine,

Edited by FRANK P. FOSTER, M. D.,

Has for its principal features LECTURES, ORIGINAL COMMUNICATIONS, CLINICAL REPORTS, CORRESPONDENCE, BOOK NOTICES, LEADING ARTICLES, MINOR PARAGRAPHS, NEWS ITEMS, LETTERS TO THE EDITOR, PROCEEDINGS OF SOCIETIES, REPORTS ON THE PROGRESS OF MEDICINE, and MISCELLANY.

So rapidly has the JOURNAL gained in public favor that it is now acknowledged to be the Leading Journal of America. It numbers among its contributors many of the most eminent men in the profession, whose papers are valuable additions to medical literature. The Society Reports, of which each number of the Journal contains several, are full of interesting and instructive matter. The Reports on the Progress of Medicine, written by men specially qualified in their respective branches, cover the most recent advances in medical science. Current events of the day are treated under the head of News Items, from a medical standpoint. Everything new and useful in materia medica is chronicled under the head of Miscellany in "Therapeutical Notes," which appear frequently, and are alone well worth the subscription price of the JOURNAL.

The arrangement of the matter in the JOURNAL enables us to furnish a greater amount of reading-matter in its twenty-eight double-columned pages than is given by any other journal of its class in America. Illustrations are more freely given than in most journals, and are, as a rule, much better executed.

To the physician who desires to keep abreast of the times in medicine and surgery, THE NEW YORK MEDICAL JOURNAL is an indispensable requisite, and to the ADVERTISER who wishes to reach the medical profession it is a medium second to none, as its rapidly increasing circulation, distributed throughout the entire Union, will abundantly prove.

Subscription price, $5.00 per annum.

JOURNAL OF CUTANEOUS AND GENITO-URINARY DISEASES,

Edited by PRINCE A. MORROW, A. M., M. D., and JOHN A. FORDCYE, M. D.

PUBLISHED MONTHLY BY D. APPLETON & CO.

The history of this JOURNAL, which is now in its seventh year of publication, has been one of progression, and, under the present editorial management, there can be no doubt that it will preserve and increase the reputation already established.

This JOURNAL is not, as its name might indicate, solely for specialists, but it appeals quite as strongly to the general practitioner, to whom it is an invaluable aid, in that it enables him to become conversant with the advances in, and the literature of, dermatology and syphilography. Devoted to the diseases indicated in its title, the JOURNAL will be contributed to by the most eminent dermatologists and syphilographers in this country. Whenever the subject requires illustration, woodcuts or chromo-lithographs will be employed.

Letters from Europe, one or more of which will appear in each issue of the JOURNAL, will keep the reader informed of the advances in this department of medicine at the great medical centers, Vienna, Berlin, and Paris.

A feature of the JOURNAL will be the publication of abstracts of translations of notable papers and selections from foreign journals.

Due prominence will be given to Society Transactions, including papers read and the discussions had thereon, so far as they have a bearing upon the subjects to which the pages of the JOURNAL are devoted.

Both the editors and the publishers will put forth every effort to make the JOURNAL instructive, attractive, and a representative one of its class; and they feel assured that every practitioner, whose work brings him in contact with cutaneous or genito-urinary diseases, will find it of great value and assistance to him.

Subscription price, $2.50 per annum.

New York: D. APPLETON & CO., 1, 3, & 5 Bond Street.

LATEST MEDICAL WORKS.

A Text-Book of Animal Physiology,

WITH INTRODUCTORY CHAPTERS ON GENERAL BIOLOGY AND A FULL TREATMENT OF REPRODUCTION. For Students of General Biology and of Human and Comparative (Veterinary) Medicine. By WESLEY MILLS, M. A., M. D., Professor of Physiology in McGill University and the Veterinary College, Montreal. With over 500 Illustrations. 8vo. Cloth, $5.00; sheep, $6.00.

"A distinctive feature of this work is that it embodies the teachings of embryology and the welding principles of evolution as part of the essential structure of zoölogy, which can not, so far as the author is aware, be said of previous books on physiology."

Exploration of the Chest in Health and Disease.

By STEPHEN SMITH BURT, M. D., Professor of Clinical Medicine and Physical Diagnosis in the New York Post-Graduate Medical School and Hospital; Physician to the Out-Door Department (Diseases of the Heart and Lungs), Bellevue Hospital. With Illustrations. 8vo, 210 pages. Cloth, $1.50.

"This is a small but exceedingly comprehensive book on auscultation and percussion, and is evidently written by one who has given frequent instruction on the subject. . . . After each disease a summary of the principal signs and symptoms is given. The book is well printed, with a sufficient number of cuts and diagrams to make it of especial value to students."—*Maryland Medical Journal.*

A Manual of Instruction in the Principles of Prompt Aid to the Injured.

DESIGNED FOR MILITARY AND CIVIL USE. By ALVAH H. DOTY, M. D., Major and Surgeon, Ninth Regiment, N. G. S. N. Y.; Attending Surgeon to Bellevue Hospital Dispensary, New York. With 96 Illustrations. 12mo. Cloth, $1.25.

This book is intended to impart the knowledge necessary for the prompt and intelligent care of persons suffering from hæmorrhage, fractures, dislocations, wounds, contusions, burns, shock, sprains, poisoning, the effects of heat or cold, apoplexy, epilepsy, those rescued from the water, and other accidents which are liable to occur at any time, the results of which may be materially influenced by the care and attention which the sufferer receives at the outset.

The Pathology and Treatment of Displacements of the Uterus.

By Dr. B. S. SCHULTZE, Professor of Gynæcology, Director of the Lying-in Institution, and of the Gynæcological Clinic, in Jena. Translated from the German by JAMESON J. MACAN, M. A., M. R. C. S. Eng., etc.; and edited by ARTHUR V. MACAN, M. B., M. Ch., etc., Master of the Rotunda Hospital, Dublin. With 120 Illustrations. 8vo, 378 pages. Cloth, $3.50.

"This book of Dr. Schultze gives, *in extenso*, his views on the whole subject of pathology and treatment of displacements, and the author has adopted the excellent plan of giving at the end of each chapter a summary of its contents. The work has numerous woodcuts which, although not pretentious, are fairly illustrative of the text."—*Journal of the American Medical Association.*

Hand-Book of Historical and Geographical Phthisiology,

WITH SPECIAL REFERENCE TO THE DISTRIBUTION OF CONSUMPTION IN THE UNITED STATES. Compiled and arranged by GEORGE A. EVANS, M. D., Member of the Medical Society of the County of Kings, New York; Member of the American Medical Association; formerly Physician to the Atlantic Avenue, and Bushwick and East Brooklyn Dispensaries, etc. 8vo, 294 pages. Cloth, $2.00.

"In compiling the above work, Dr. Evans has rendered a most useful service to the profession. Heretofore it has been necessary to glean from many sources the knowledge here contained in one small volume. Any one who has had occasion to perform this arduous work will appreciate at once the labors of the author. . . ."—*Buffalo Medical and Surgical Journal.*

New York: D. APPLETON & CO., Publishers, 1, 3, & 5 Bond Street.

Prof. JOSEPH LE CONTE'S WORKS.

Elements of Geology.

A Text-Book for Colleges and for the General Reader. By JOSEPH LE CONTE, LL. D., Professor of Geology and Natural History in the University of California. With upward of 900 Illustrations. New and enlarged edition. 8vo. Cloth, $4.00.

"A good college text-book of geology has hitherto been wanting. Besides preparing a comprehensive text-book, suited to present demands, Prof. Le Conte has given us a volume of great value as an exposition of the subject, thoroughly up to date. The examples and applications of the work are almost entirely derived from this country, so that it may be properly considered an American geology. This is of advantage to the American student."—*Popular Science Monthly.*

Religion and Science.

A Series of Sunday Lectures on the Relation of Natural and Revealed Religion, or the Truths revealed in Nature and Scripture. By JOSEPH LE CONTE, LL. D. 12mo. Cloth, $1.50.

"Prof. Le Conte grapples with some of the gravest questions which agitate the thinking world. He treats of them all with dignity and fairness, and in a manner so clear, persuasive, and eloquent, as to engage the undivided attention of the reader."—*Boston Journal.*

"This volume is written with much clearness of thought and unusual clearness of expression. It is partly a treatise on natural theology and partly a defense of the Bible against the assaults of modern science. In the latter aspect the author's method is an eminently wise one. He accepts whatever science has proved, and he also accepts the divine origin of the Bible. Where the two seem to conflict, he prefers to await the reconciliation, which is inevitable if both are true, rather than to waste time and words in inventing ingenious and doubtful theories to force them into seeming accord. Both as a theologian and a man of science, Prof. Le Conte's opinions are entitled to respectful attention, and there are few who will not recognize his book as a thoughtful and valuable contribution to the best religious literature of the day."—*New York World.*

Evolution and its Relation to Religious Thought.

By JOSEPH LE CONTE, LL. D. With numerous Illustrations. 12mo. Cloth, $1.50.

"I have attempted to give (1) a very concise account of what we mean by evolution, (2) an outline of the evidences of its truth drawn from many different sources, and (3) its relation to fundamental religious beliefs."—*Extract from Preface.*

Compend of Geology.

By JOSEPH LE CONTE, Professor of Geology and Natural History in the University of California. 12mo. Cloth, $1.40.

Sight.

An Exposition of the Principles of Monocular and Binocular Vision. By JOSEPH LE CONTE, LL. D. With Illustrations. 12mo. Cloth, $1.50.

"Prof. Le Conte has long been known as an original investigator in this department; all that he gives us is treated with a master-hand."—*The Nation.*

New York: D. APPLETON & CO., 1, 3, & 5 Bond Street.

VALUABLE BOOKS RELATING TO CHEMISTRY.

WAGNER, RUDOLPH. Hand-Book of Chemical Technology. Translated and edited from the eighth German edition, with extensive Additions, by WILLIAM CROOKES, F. R. S. With Three Hundred and Thirty-six Illustrations. 8vo. Cloth, $5.00.

STRECKER AND WISLICENUS. Short Text-Book of Organic Chemistry. Translated and edited, with extensive Additions, by W. R. HODGKINSON, Ph. D. (Würzburg), and A. J. GREENAWAY, F. I. C., F. C. S. Small 8vo. Cloth, $5.00.

ROSCOE AND SCHORLEMMER. A Treatise on Chemistry. By H. E. ROSCOE, F. R. S., and C. SCHORLEMMER, F. R. S., Professors of Chemistry in the Victoria University, Owens College, Manchester. With Illustrations.

Inorganic Chemistry. Vols. I and II, 8vo.

Vol. I. **The Non-Metallic Elements.** Containing a Portrait of Dutton, engraved by C. H. Jeens. Cloth, $5.00.

Vol. II. **Metals.** Two Parts. Cloth, $3.00 each.

Organic Chemistry. 8vo.

Vol. III. **The Chemistry of the Hydrocarbons and their Derivatives.** Parts I and II, $5.00 each; Part III, $3.00; Part IV, $3.00; Part V, $3.00.

COOKE, Professor JOSIAH PARSONS, Jr., of Harvard University. **The New Chemistry.** 12mo. Cloth, $2.00.

JOHNSTON, Professor JAMES F. W. The Chemistry of Common Life. A new edition, revised, enlarged, and brought down to the Present Time. By ARTHUR HERBERT CHURCH, M. A., Oxon., author of "Food; its Sources, Constituents, and Uses." Illustrated with Maps and numerous Engravings on Wood. 12mo. Cloth, $2.00.

RAINS, GEORGE W., M. D. Chemical Exercises in Qualitative Analysis, for Ordinary Schools. By GEORGE W. RAINS, M. D., Professor of Chemistry and Pharmacy in the Medical Department of the University of Georgia, etc. Cloth, flexible, 50 cents.

CLARKE, Professor F. W., Chemist of the United States Geological Survey. **Elements of Chemistry.** 12mo. Cloth, $1.40.

WILLIAMS, W. MATTIEU. The Chemistry of Cookery. 12mo. Cloth, $1.50.

VOGEL, Dr. HERMANN. The Chemistry of Light and Photography. With One Hundred Illustrations. 12mo. Cloth, $2.00.

YOUMANS, Professor E. L. Class-Book of Chemistry. New edition. 12mo. Cloth, $1.40.

New York: D. APPLETON & CO., 1, 3, & 5 Bond Street.

STANDARD HISTORICAL WORKS

Published by D. APPLETON & CO.

History of the World,

FROM THE EARLIEST RECORDS TO THE FALL OF THE WESTERN EMPIRE. By PHILIP SMITH, B. A. New edition. 3 vols., 8vo. Vellum cloth, gilt top, $6.00; half calf, $13.50.

"These volumes embody the results of many years of arduous and conscientious study. The work is fully entitled to be called the ablest and most satisfactory book on the subject written in our language. The author's methods are dignified and judicious, and he has availed himself of all the recent light thrown by philological research on the annals of the East."—*Dr. C. K. Adams's Manual of Historical Literature.*

History of Herodotus.

An English Version, edited, with Copious Notes and Appendices, by GEORGE RAWLINSON, M. A. With Maps and Illustrations. In four volumes, 8vo. Vellum cloth, $8.00; half calf, $18.00.

"This must be considered as by far the most valuable version of the works of 'The Father of History.' The history of Herodotus was probably not written until near the end of his life; it is certain that he had been collecting materials for it during many years. There was scarcely a city of importance in Greece, Asia Minor, Syria, Persia, Arabia, or Egypt, that he had not visited and studied; and almost every page of his work contains results of his personal inquiries and observations. Many things laughed at for centuries as impossible, are now found to have been described in strict accordance with truth."—*Dr. C. K. Adams's Manual of Historical Literature.*

A History of Greece.

FROM THE EARLIEST TIMES TO THE PRESENT. By T. T. TIMAYENIS. With Maps and Illustrations. 2 vols. 12mo. Cloth, $2.50.

"The peculiar feature of the present work is that it is founded on Hellenic sources. I have not hesitated to follow the Father of History in portraying the heroism and the sacrifices of the Hellenes in their first war for independence, nor, in delineating the character of that epoch, to form my judgment largely from the records he has left us."—*Extract from Preface.*

Greece in the Times of Homer.

An Account of the Life, Customs, and Habits of the Greeks during the Homeric Period. By T. T. TIMAYENIS. 16mo. Cloth, $1.50.

"In the preparation of the present volume I have conscientiously examined nearly every book—Greek, German, French, or English—written on Homer. But my great teacher and guide has been Homer himself."—*From the Preface.*

Life of the Greeks and Romans,

DESCRIBED FROM ANCIENT MONUMENTS. By E. GUHL and W. KONER. Translated from the third German edition by F. HUEFFER. With 543 Illustrations. Large 8vo. Cloth, $2.50.

"The result of careful and unwearied research in every nook and cranny of ancient learning. Nowhere else can the student find so many facts in illustration of Greek and Roman methods and manners."—*Dr. C. K. Adams's Manual of Historical Literature.*

History of Rome.

By Dr. THOMAS ARNOLD. Large 8vo. Cloth, $3.00.

Dr. Arnold's colossal reputation is founded on this great work.

The French Revolution.

By LOUIS ADOLPHE THIERS. In 4 vols. 8vo. Vellum cloth, gilt top, in box, $8.00; half calf, $18.00.

The French Revolutionary Epoch.

Being a History of France from the Beginning of the first French Revolution to the End of the Second Empire. By HENRI VAN LAUN, author of "History of French Literature," etc. In 2 vols. 12mo. Cloth, $3.50.

This is a work for which there is no substitute at present in the English language."—*New York Sun.*

History of Civilization.

By FRANÇOIS P. G. GUIZOT. 2 vols. 12mo. Cloth, $4.00; half calf, $8.00.

"The most famous of Guizot's works. The lectures made a profound impression at the time of their appearance—indeed, formed an epoch in the history of education: and even at the present day perhaps no other historical book is capable of stirring more earnest and fruitful thought in a thoughtful student."—*Dr. C. K. Adams's Manual of Historical Literature.*

A History of England in the Eighteenth Century.

By WILLIAM E. H. LECKY, Volumes I to VI, bringing the history down to 1793. One more volume will complete the work. Large 12mo. Cloth, $2.25 each volume; half calf, $4 50 each volume.

"On every ground which should render a history of eighteenth-century England precious to thinking men, Mr. Lecky's work may be commended. The materials accumulated in these volumes attest an industry more strenuous and comprehensive than that exhibited by Froude or by Macaulay. But it is his supreme merit that he leaves on the reader's mind a conviction that he not only possesses the acuteness which can discern the truth, but the unflinching purpose of truth-telling."—*New York Sun.*

Origins of the English People and of the English Language.

Compiled from the Best and Latest Authorities. By JEAN ROEMER, LL. D., Professor of the French Language and Literature, and Vice-President of the College of the City of New York. With Chart and Lithographic Fac-similes of Anglo-Saxon and Early French Writings. 1 vol., 8vo. Cloth, $3.50.

This work is essentially an introduction to the study of early English literature. Founded on the latest works of specialists, who have explored the many branches of the subject, it traces the sources of Modern English among the various races of men—Celts, Romans, Saxons, Danes, and Normans—who, at various epochs, have found their way into the British Isles; and, by inquiring into the origin and national characteristics of these races, their customs, wants, and forms of religion, the social and political differences, their relative progress in the arts of civilized life, it enables the student to draw his own conclusions as to the various influences tending to a corresponding fusion of their various idioms and dialects, resulting in the formation of that great and wonderful language which, from a mere jargon, as it was at first, has grown into the national speech of England.

The Leaders of Public Opinion in Ireland: Swift, Flood, Grattan, O'Connell.

By WILLIAM E. H. LECKY. 12mo. Cloth, $1.75.

History of the Rise and Influence of the Spirit of Rationalism in Europe.

By WILLIAM E. H. LECKY. 2 vols. Small 8vo. Cloth, $4.00; half calf, extra, $8.00.

"Mr. Lecky is the historian of the rise and progress of that resistance to the Christianity of clerical interpretation which has gone by the names of private judgment, rationalism, latitudinarianism, blasphemy, infidelity, or atheism, according to the speaker and his bias. Mr. Lecky is learned, sensible, and readable, and we wish his book a wide circulation. It comes at a time when it is wanted."—*Athenæum, London.*

History of European Morals from Augustus to Charlemagne.

By WILLIAM E. H. LECKY, 2 vols. 12mo. Cloth, $3.00; half calf, extra, $7.00.

"So vast is the field Mr. Lecky introduces us to, so varied and extensive the information he has collected in it, fetching it from far beyond the limits of his professed subject, that it is impossible in any moderate space to do more than indicate the line he follows. . . . The work is a valuable contribution to our higher English literature, as well as an admirable guide for those who may care to go in person to the distant fountains from which Mr. Lecky has drawn for them so freely."—*London Times.*

History of Civilization in England.

By HENRY THOMAS BUCKLE. 2 vols., 8vo. Cloth, $4.00; half calf, extra, $8.00.

"We may fairly defy the most hostile spirit, the most mistrustful and least sympathetic, to read the book through without being glad of having done so, or, having begun it, or even glanced at almost any one of its pages, to pass it away unread."—*New Monthly Magazine (London).*

The English Constitution,

And other Political Essays. By WALTER BAGEHOT. Latest revised edition. Containing Essays on the Characters of Lord Brougham and Sir Robert Peel, Bart. With an American Preface. 12mo. Cloth, $2.00.

"We doubt if there is any other volume so useful for our countrymen to peruse before visiting England."—*From the American Preface.*

Rise and Progress of the English Constitution.

By Sir EDWARD S. CREASY. 12mo. Cloth, $1.50.

"As a manual for the use of the historical student while he is laying the foundation for a knowledge of the English Constitution, this little book is without a superior. It combines accuracy with vivacity, and should be constantly used by the student in the early period of his studies."—*Dr. C. K. Adams's Manual of Historical Literature.*

Thirty Years' View;

Or, A History of the Working of the American Government for Thirty Years, from 1820 to 1850. By THOMAS H. BENTON. With Index. 2 large vols., 8vo. Cloth, $6.00; sheep, $8.00.

The Household History of the United States and its People.

For Young Americans. By EDWARD EGGLESTON. Illustrated with 75 Historical Maps and Diagrams, and more than 350 Drawings by the best artists, exhibiting Historical Events, Costumes, Manners and Customs, Arms, Implements, Inventions, Modes of Travel, etc. Square 8vo. Cloth, decorated, $2.50.

This work is illustrated in a novel and strikingly effective manner. Engravings adorn every page, and appear in the text and in the margins. There are full-page illustrations in colors, maps in colors line the covers, and many small maps are inserted in the text. The work is handsomely printed, and bound in a very attractive manner.

History of the Romans under the Empire.

By CHARLES MERIVALE, B. D., Rector of Lawford; Chaplain to the House of Commons. 7 vols. Small 8vo. Cloth, $14.00.

THE SAME. New edition. 7 vols. in four. 12mo. Cloth, $7.00; half calf, $15.00.

"A work that has justly taken high rank in the historical literature of modern England. Some of his chapters must long be regarded as admirable specimens of elegant literary workmanship. The author begins his history with the gradual transfer of the old Republic to the imperialism of the Cæsars, and ends it with the age of the Antonines. It therefore exactly fills the gap between Mommsen and Gibbon."—*Dr. C. K. Adams's Manual of Historical Literature.*

Montesquieu's Considerations on the Causes of the Grandeur and Decadence of the Romans.

A New Translation, together with an Introduction, Critical and Illustrative Notes, and an Analytical Index. By JEHU BAKER. Being incidentally a Rational Discussion of the Phenomena and the Tendencies of History in General. 12mo. Cloth, $2.00.

Manual of Ancient and Modern History.

By W. C. TAYLOR, LL. D., M. R. A. S. Revised by C. S. HENRY, D. D. 8vo. Cloth, $3.50; or, in separate volumes, $2.00 each.

ANCIENT HISTORY.—Containing the Political History, Geographical Position, and Social State of the Principal Nations of Antiquity, carefully digested from the Ancient Writers, and illustrated by the Discoveries of Modern Scholars and Travelers.

MODERN HISTORY.—Containing the Rise and Progress of the Principal European Nations, their Political History, and the Changes in their Social Condition; with a History of the Colonies founded by Europeans.

The History of Ancient Civilization.

A Hand-book based upon M. Gustave Ducoudray's "Histoire Sommaire de la Civilisation." Edited by the Rev. J. VERSCHOYLE, M. A. With numerous Illustrations. Large 12mo. Cloth, $1.75.

History of the Middle Ages.

By A. L. KOEPPEN. 2 vols. 12mo. Cloth, $3.00.

This truly excellent work supplies, in a very satisfactory manner, a want long felt by every student of history. It is concise in style, comprehensive in matter, lucid in arrangement, and full of ripe scholarship and research. The author's purpose was to present an accurate description of the world during the different periods from the ultimate division of the Roman Empire down to the conquest of Constantinople.

A History of Charles the Great (Charlemagne).

By J. I. Mombert, D. D. 8vo. Cloth, $5.00.

This work, which consists largely of matter now presented for the first time in English, rests almost wholly on the *contemporary* authority of Annals and Chronicles, Biographies, Letters, Laws, Poems, Inscriptions, etc.

Eighteen Christian Centuries.

By Rev. James White. With Copious Index. 12mo. Cloth, $2.00.

The best epitome of Christian history extant. Mr. White possesses in a high degree the power of distilling the essence from a mass of facts, and condensing events in description. A battle or a siege which, without his skill, would occupy a chapter, is compressed by him into a page or two, without sacrificing any essential or significant feature.

Lectures on Modern History.

By Dr. Thomas Arnold. 12mo. Cloth, $1.50.

These lectures are universally admitted to be among the most valuable of Dr. Arnold's works. They make the reader acquainted with the true method of historical inquiry. Even a cursory reading of Macaulay shows that their methods were identical—namely, to exhaust all the topics of inquiry, and leave nothing which can illustrate the actual life of past ages unexamined.

History of France.

By Jules Michelet. 2 vols. 8vo. Cloth, $4.00; half calf, $9.00.

"Michelet had the substantial qualifications of patient industry and vast erudition, but he had much more. He was endowed with a subtle and powerful imagination, and with an extraordinary gift in the art of historical delineation. These varied qualifications made him one of the most graphic and spirited of all modern historians. There is perhaps no more brilliant historical writing in any language than some of the writing of Michelet."—*Dr. C. K. Adams's Manual of Historical Literature.*

History of France,

FROM THE EARLIEST TIMES TO 1848. By Rev. James White. Large 8vo. Cloth, $3.00.

"The author's merit was in his ability to seize upon the salient points of a topic, and present them in such a manner as to interest the general reader. This is the book to be chosen for those who 'need to be tempted' to the study of French history."—*Dr. C. K. Adams's Manual of Historical Literature.*

The English Reformation:

How it Came about, and why we should Uphold it. By Cunningham Geikie, D. D., author of "The Life and Words of Christ." 12mo. Cloth, $2.00.

"His grouping of facts is often masterly, his style is bold and incisive, and his sketches of eventful periods or eminent personages are vivid and graphic."—*Harper's New Monthly Magazine.*

Anecdotal History of the British Parliament.

From the Earliest Periods to the Present Time, with Notices of Eminent Parliamentary Men and Examples of their Oratory. Compiled by G. H. Jennings. Crown 8vo. Cloth, $2.50.

"As pleasant a companion for the leisure hours of a studious and thoughtful man as anything in book-shape since Selden."—*London Telegraph.*

"It would be sheer affectation to deny the fascination exercised by the 'Anecdotal History of Parliament.'"—*Saturday Review.*

History of the United States of America,

From the Discovery of the Continent to the Establishment of the Constitution in 1789. By GEORGE BANCROFT. The Author's last revision. Complete in six volumes, 8vo. Price, in Sets: Blue cloth, gilt top, uncut edge, $15.00; brown cloth, gilt top, uncut edge, paper titles, $15.00; sheep, marble edge, $21.00; half morocco, gilt top, uncut edge, $27.00; half calf, marble edge, $27.00; half-grained morocco, gilt top, uncut edge, $27.00.

The six volumes of this new and fully revised edition of Bancroft's "History of the United States," now complete, comprise the twelve volumes of the original octavo edition, including the "History of the Formation of the Constitution," last published, and are issued at just half the price. Volume VI contains a new Portrait of Bancroft engraved on Steel.

History of the Formation of the Constitution of the United States.

By GEORGE BANCROFT. 8vo. Cloth, $2.50.

This volume includes the original two-volume edition of the work, with an Appendix, containing the Constitution and Amendments. It is designed for the convenience of students, and is sold separately from the other volumes of Bancroft's History.

History of the People of the United States,

From the Revolution to the Civil War. By JOHN B. MCMASTER. To be completed in 5 vols., 8vo. Vols I and II now ready. Cloth, $2.50 each.

The Historical Reference-Book,

Comprising a Chronological Table of Universal History, a Chronological Dictionary of Universal History, and a Biographical Dictionary. With Geographical Notes. For the Use of Students, Teachers, and Readers. By LOUIS HEILPRIN. New edition. Crown 8vo, 579 pages. Half leather, $3.00.

As a book of compact reference this work is believed to possess considerable advantage in its arrangement over other books of the kind—reference being in one Part under dates, and in another under countries or events—while every effort has been made to render it absolutely accurate. The compiler had many years' experience in the editorial department of the "American Cyclopædia" in verifying historical and biographical dates.

Great Leaders: Historic Portraits from the Great Historians.

Consisting of Eighty Selections from the Writings of PLUTARCH, GROTE, GIBBON, CURTIUS, MOMMSEN, FROUDE, HUME, MACAULAY, LECKY, GREEN, THIERS, TAINE, PRESCOTT, MOTLEY, and other Historians. With Notes and brief Biographical Sketches by T. G. FERRIS, and 16 Engraved Portraits. 12mo. Cloth, $1.75.

James G. Birney and his Times:

THE GENESIS OF THE REPUBLICAN PARTY, WITH SOME ACCOUNT OF ABOLITION MOVEMENTS IN THE SOUTH BEFORE 1828. By WILLIAM BIRNEY. With Portrait. 12mo. Cloth, $2.00.

"The times in which Mr. Birney lived are among the most important this country has known. A book, written with judicial calmness, and reliably showing the stirring and significant events of those days, must be of necessity invaluable. Such is this work. It accurately shows the origin of the Republican party, and arrays the facts of the earlier history of this country in so striking a manner as to illustrate the statement that 'the abolition of slavery in the United States was neither an accident nor a miracle; it was a result of evolution."—*The Observer.*

New York: D. APPLETON & CO., Publishers, 1, 3, & 5 Bond Street.

COOLEY'S

Cyclopædia of Practical Receipts,

AND

Collateral Information in the Arts, Manufactures, Professions, and Trades, including Medicine, Pharmacy, and Domestic Economy.

Designed as a Comprehensive Supplement to the Pharmacopœia, and General Book of Reference for the Manufacturer, Tradesman, Amateur, and Heads of Families.

SIXTH EDITION.

Revised and partly rewritten by

RICHARD V. TUSON,

PROFESSOR OF CHEMISTRY AND TOXICOLOGY IN THE ROYAL VETERINARY COLLEGE.

Complete in two volumes, 8vo, 1,796 pages. With Illustrations. Price, $9.00.

COOLEY'S CYCLOPÆDIA OF RECEIPTS has for many years enjoyed an extended reputation for its accuracy and comprehensiveness. The sixth edition, now just completed, is larger than the last by some six hundred pages. Much greater space than hitherto is devoted to Hygiene (including sanitation, the composition and adulteration of foods), as well as to the Arts, Pharmacy, Manufacturing Chemistry, and other subjects of importance to those for whom the work is intended. The articles on what is commonly termed "Household Medicine" have been amplified and numerically increased.

"The great characteristic of this work is its general usefulness. In covering such diverse subjects, the very best and most recent research seems to have been sought for, and the work is remarkable for intelligent industry. This very complete work can, then, be highly recommended as fulfilling to the letter what it purports to be—a cyclopædia of practical receipts."—*N. Y. Times.*

"It is a well-edited special work, compiled with excellent judgment for special purposes, which are kept constantly in mind. If it is more comprehensive than its title suggests, that is only because it is impossible to define the limits of its purpose with exactitude, or to describe its contents upon a title-page. Illustrations of the text are freely used, and the mechanical execution of the work is excellent."—*New York Evening Post.*

"The book may be characterized in a word as a sort of domestic cyclopædia, containing in the articles alphabetically arranged information on all sorts of topics related to home life, and information put not in an abstract way, or for mere scientific information, but in a concrete way, and for the practical service of the household. Turning over the pages, to give our readers some conception of the book, we find in it such articles as Acetic Acid, which gives the sources from which and the methods by which it is procured, and its uses and dangers; Adulteration, which, besides a very brief history of adulterations, gives in alphabetical order a list of the articles most commonly adulterated, with the names of the substances used for that purpose; Ague, which states the symptoms and external causes of the disease, and briefly suggests methods of prevention. These articles may serve as types, to give the reader some idea of the general spirit and character of the book for the manufacturer, the storekeeper, and the household. It is an exceedingly valuable book of reference."—*The Christian Union.*

D. APPLETON & CO., Publishers,
1, 3, & 5 BOND STREET, NEW YORK.

STANLEY'S OWN BOOK.

By direct arrangement with Henry M. Stanley, securing to them all American rights, Messrs. Charles Scribner's Sons will publish at an early day the first and only authentic story of the Emin Pasha Relief Expedition that will be published in this country; the only one that will be written by Mr. Stanley himself, or with his consent or authority; and the only one in which he will have any personal interest. Mr. Stanley took the precaution to pledge his companions in the outset to furnish nothing for publication on this subject; the pledge has been faithfully kept, and he has neither written nor authorized anything himself, beyond a few brief letters that have already been published. Remember that STANLEY'S OWN BOOK WILL BEAR ON THE TITLE-PAGE THE IMPRINT OF CHARLES SCRIBNER'S SONS, and that he will write nothing more concerning his last expedition, excepting what will appear in "SCRIBNER'S MAGAZINE." The book will be in two volumes of about 500 pages each, well provided with maps, and amply illustrated from Mr. Stanley's own photographs and sketches. It will be sold only by subscription. Agents wanted everywhere.

CHARLES SCRIBNER'S SONS,

743 & 745 Broadway, New York.

CURNEY HOT-WATER HEATER AND RADIATOR.

Nature's Greatest Aide-de-camp.

HEATER.

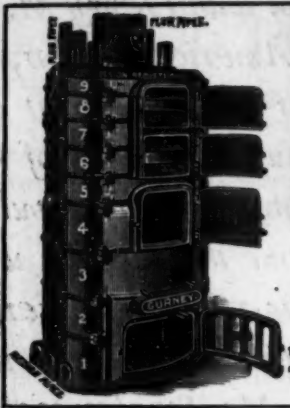
Safe,

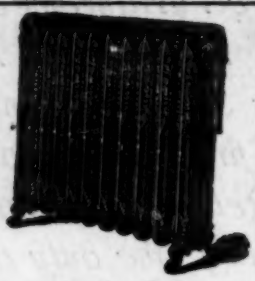
Economical,

Portable,

Durable,

Efficient.





GURNEY RADIATOR.

Send for "How Best to Heat our Homes, and Testimonial Companion."

RADIATOR.

Artistic,

Practical,

Simple,

Compact,

Positive

Circulation.

No safety valves or automatic appliances to get out of order or cause Danger. Positively No Danger of leakage.

CURNEY HOT-WATER HEATER CO.

PRINCIPAL OFFICE, 163 Franklin Street, cor. Congress, Boston, Mass.
NEW YORK OFFICE, 88 John Street, cor. Gold.

SELLING AGENCIES:

CHICAGO, Rice & Whitacre Mfg. Co., 47 & 49 S. Canal St.
PORTLAND, OR., and TACOMA, WASH., Wm. Gardner & Co.
SPOKANE FALLS, WASH., Falls City Plumbing and Heating Co.
CHARLESTON, S. C., Valk & Murdock, 16, 18, & 20 Hasell St.
COVINGTON, KY., J. L. Frisbie, 526 Philadelphia St.

ROSES GIVEN AWAY.

Send 25 cents for **PARK'S NEW ROSE BUDGET**—all about Roses—superbly illustrated, elegant frontispiece in colors, full of cultural and descriptive notes, the delight of every rosarian; with it you will get as a **free gift**, by mail, **two fine plants** of those **grandest of all Everblooming Roses**, namely:

Souv. de Wootton, new, rich crimson-scarlet, value..... **25c.**
La France, exquisite satin rose, value ..... **20c.**

These are decidedly the **best** Roses in cultivation. Both are hardy, deliciously fragrant, exquisite in form and color, and bloom freely and continuously either in pots or beds. The **sweetest, loveliest, quaintest grown, most prolific**, and in every way the **best Roses known.** This rare offer will not appear again. Send at once. Tell your friends. Ten splendid Roses and Park's Floral Magazine, a charming monthly, one year, all for $1.00.

G. W. PARK, Parkton, Metal P. O., Pa.

P.S.—PARK'S FLORAL GUIDE, with Mixed Flower Seeds, Certificate, etc., only 10c. Order it also.

CARLISLE N. GREIG,

INVESTMENT SECURITIES.

Send for my "POINTS TO INVESTORS," a carefully prepared pamphlet about Colorado Securities. Every facility furnished investors to investigate my offerings **netting from six to eight per cent.** References: C. B. Kountze, very Rev. H. Martyn Hart, Chief-Justice Helm, Denver, Colo., Bishop Doane, Erastus Corning, J. Howard King, Albany, N. Y., Henry Day, John A. McCall, R. G. Dun & Co., N. Y. City, and many others.

P. O. BOX, 1573. DENVER, COLO.

THE KEYSTONE MORTGAGE CO.,
Aberdeen, South Dakota, offers choice 7% Guaranteed Mortgages and 6% Debentures. Write them for full information and references.

EASTERN OFFICE, 1328 Chestnut Street, Philadelphia, Pa.

A COMPLETE GYMNASIUM: "HEALTH AND STRENGTH APPARATUS" for home, school and office. Adaptable to all, from the weakest to the strongest. Indorsed by Drs., parents, teachers, merchants, clerks, students, people of sedentary pursuits and invalids. No floor room. Circular free. Agts. wanted. Send $1 for book: "An Ideal Complexion, Face, Neck, Shoulder, Arm and Chest Development." Yours in Health and Strength.

PROF. JNO. E. DOWD, Ad.
186 Clark St., CHICAGO, Ills.

Appletons' General Guide to the United States and Canada.

With Railway Maps, Plans of Cities and Illustrations.

Two Parts bound in one volume, 16mo.

Roan tuck. Price, $2.50.

D. APPLETON & CO., PUBLISHERS,
1, 3, & 5 Bond Street, New York.

An elegant dressing exquisitely perfumed, removes all impurities from the scalp, prevents baldness and gray hair, and causes the hair to grow Thick, Soft and Beautiful. Infallible for curing eruptions, diseases of the skin, glands and muscles, and quickly healing cuts, burns, bruises, sprains, &c.

Price, 50 Cents.—All Druggists.

BARCLAY & CO., New York.

MANN'S REFERENCE INDEXES.—References to and transcripts or translations of the literature of *any subject* furnished by B. PICKMAN MANN, Washington, D. C. Correspondence fee, 50 cents. Explanatory circulars free.

1000 SILK FRINGE, PHOTO. CARDS, etc., 20 New Songs, 1 pack Escort Cards, 1 pack Love Cards, 876 Rich & Racy Jokes, Tricks, Games, and New Sample Book of (genuine) Cards 2 cts. CROWN CARD CO., CADIZ, OHIO.

PATENTS FRANKLIN H. HOUGH, Washington, D. C. No attorney's fee until Patent obtained. Write for **Inventor's Guide.**

SHORTHAND in 10 lessons. Celebrated Pernin Method. No shading, no position. Trial lesson free. Write PERNIN SHORTHAND INSTITUTE, Detroit, Mich.

CALIGRAPH

GREATEST SPEED!

BEST FOR MANIFOLDING.

100,000 Daily users.

THE MOST DURABLE.

PRICE, - EIGHTY-FIVE DOLLARS.

For account of speed contests and Circulars, address,

THE AMERICAN WRITING MACHINE CO.

HARTFORD, CONN.

BRANCH OFFICES:—237 BROADWAY, NEW YORK. 14 WEST 4TH STREET, CINCINNATI, O. 1003 ARCH STREET, PHILADELPHIA.

GRAPE VINES

Largest Stock in America. **NIAGARA** and all old and new varieties. *Extra Quality.* Warranted true. Lowest rates. Introducers of the *new Black Grape* **EATON.**

Also other **SMALL FRUITS.** Descriptive Catalogue **Free.** Send list for prices. T. S. HUBBARD CO., FREDONIA, N. Y.

PERFECT COMPLEXIONS. Use **Mme. A. Ruppert's** World-Renowned Face Bleach 30 days. It will clear thoroughly your complexion, and remove freckles, pimples, moth and all roughness or discoloration from the skin; 1 bottle, $2; 3 bottles (usually required to clear the complexion), $5. Send 4 cts. postage for catalogue and sealed particulars containing highest testimonials, etc.,

Address MME. A. RUPPERT, 30 East 14th St., New York, N. Y.

DR. SYKES' SURE CURE FOR CATARRH

ESTABLISHED CHICAGO 1870.

1888 Removed to CINCINNATI.

Has cured many cases pronounced hopeless by physicians. Send for *Free Book* 'Common Sense Talk' and numerous testimonials. They will convince you.

Dr. SYKES' SURE CURE CO., 330 Race St., Cincinnati, O.

ESTERBROOK'S PENS.

Standard and superior quality. Leading Nos. 048, 14, 130, 135, 239, 313, 333. All Stationers have them.

THE ESTERBROOK STEEL PEN CO., 26 John Street, New York.

ESTAB. 1825. PHILA. U. S. A.

FRED. BROWN'S GINGER

FOR CRAMPS AND COLIC.

GET THE GENUINE. IMITATIONS ARE OFFERED—THEY ARE WORTHLESS

Good morning!
Have you used
Pears' Soap?

VOL. XXXVI.] ESTABLISHED BY EDWARD L. YOUMANS. [No. 6.

THE POPULAR SCIENCE MONTHLY.

APRIL, 1890.

EDITED BY WILLIAM JAY YOUMANS.

CONTENTS.

PAGE

I. Science in the High School. By Prof. DAVID STARR JORDAN.. 721
II. Ethics and Religion. By Prof. CRAWFORD HOWELL TOY..... 727
III. Darwin on the Fuegians and Patagonians. (Illustrated.)..... 744
IV. Is Education opposed to Motherhood? By ALICE B. TWEEDY.. 751
V. On the Natural Inequality of Men. By Prof. T. H. HUXLEY.. 761
VI. Sloyd. By FRIMANN B. ARNGRIMSSON. (Illustrated.)..... 784
VII. The Mysterious Music of Pascagoula. By CHARLES E. CHIDSEY. 791
VIII. The Indwelling Spirits of Men. By Hon. Major A. B. ELLIS... 794
IX. Northern Lights. By WILHELM STOSZ..... 801
X. Dragons, Fabled and Real. By M. MAURICE MAINDRON. (Illus.). 808
XI. Alchemist's Gold. By M. A. DE ROCHAS..... 814
XII. A Lesson in Co-operation. By CLARENCE N. OUSLEY..... 821
XIII. Intelligence of Squirrels. By Dr. T. WESLEY MILLS..... 829
XIV. Sketch of David Rittenhouse. (With Portrait.)..... 835
XV. Correspondence: Moral Instruction in our Public Schools.—Politics and Farm Mortgages.—Rigidity of the Suspension Bridge.—The Salt Product of Kansas. 843
XVI. Editor's Table: Political Economy.—Example in Moral Teaching.—An Unfounded Statement..... 845
XVII. Literary Notices..... 848
XVIII. Popular Miscellany..... 858
XIX. Notes..... 85

NEW YORK:
D. APPLETON AND COMPANY,
1, 3, AND 5 BOND STREET.

SINGLE NUMBER, 50 CENTS. YEARLY SUBSCRIPTION, $5.00.

COPYRIGHT, 1890, BY D. APPLETON AND COMPANY.

Entered at the Post-Office at New York, and admitted for transmission through the mails at second-class rates.

DECKER BROTHERS

MATCHLESS PIANOS.

STYLES; BABY GRANDS, PARLOR GRANDS, CONCERT GRANDS, CABINET GRANDS, UPRIGHTS AND SQUARES.

In Circassian Walnut, English Oak, Hungarian Ash, Mahogany, and Ebonized Cases.

ARTISTIC DESIGNS TO ORDER.

WAREROOMS,

33 UNION SQ., NEW YORK.

WILLIAM KNABE & CO.'S

GRAND, SQUARE, AND

UPRIGHT PIANO-FORTES.

PIANO FACTORY,

BALTIMORE, MD.

These instruments have been before the public for nearly fifty years, and upon their excellence alone have attained an *unpurchased pre-eminence*, which establishes them as unequaled in Tone, Touch, Workmanship, and Durability. Every Piano fully warranted for five years. Prices greatly reduced. Illustrated Catalogues and Price-Lists promptly furnished on application.

WILLIAM KNABE & CO.,

148 Fifth Avenue, near 20th St., New York. 23 & 24 E. Baltimore Street, Baltimore

817 Market Space, Pennsylvania Avenue, Washington, D. C.

Remington

Standard Typewriter

HAS BEEN FOR

FIFTEEN YEARS

THE STANDARD,

And embraces the Latest and Highest Achievements of Inventive Skill.

WYCKOFF, SEAMANS & BENEDICT,

327 Broadway, N. Y.

GOLD MEDAL, PARIS, 1878.

W. BAKER & Co.'s Breakfast Cocoa

from which the excess of oil has been removed,

Is Absolutely Pure and it is Soluble.

No Chemicals

are used in its preparation. It has *more than three times the strength* of Cocoa mixed with Starch, Arrowroot or Sugar, and is therefore far more economical, *costing less than one cent a cup.* It is delicious, nourishing, strengthening, EASILY DIGESTED, and admirably adapted for invalids as well as for persons in health.

Sold by Grocers everywhere.

W. BAKER & CO., DORCHESTER, MASS.

FORTY-FIFTH ANNUAL REPORT OF THE

NEW YORK LIFE INS. CO.

OFFICE, Nos. 346 & 348 BROADWAY, NEW YORK.

JANUARY 1, 1890.

Amount of net assets, January 1, 1889 ..... $89,824,336 19

REVENUE ACCOUNT.

Premiums	$26,011,835 36	
Less deferred premiums, January 1, 1889	1,435,734 16	$24,583,921 10
Interest and rents, etc.	5,008,950 38	
Less interest accrued January 1, 1889	451,605 24	4,557,343 14—$29,141,264 24
		$118,987,602 43

DISBURSEMENT ACCOUNT.

Losses by death, and endowments matured and discounted (including reversionary additions to same)		$6,831,038 50
Dividends (including mortuary dividends), annuities, and purchased insurances		5,[illegible] 18
Total paid policy-holders	$12,121,121 68	
Taxes and reinsurances		854,727 17
Commissions (including advanced and commuted commissions), brokerages, agency expenses, physicians' fees, etc.		4,735,432 64
Office and law expenses, rentals, salaries, advertising, printing, etc.		860,788 50—$17,380,179 97
		$101,027,322 46

ASSETS.

Cash on deposit, on hand, and in transit		$3,317,837 78
United States bonds and other bonds and stocks (market value, $60,138,441 91)		58,413,183 41
Real estate		23,342,871 87
Bonds and mortgages, first lien on real estate (buildings thereon insured for $15,500,000 and the policies assigned to the Company as additional collateral security)		18,106,312 50
Temporary loans (market value of securities held as collateral, $4,677,563)		3,709,000 00
*Loans on existing policies (the reserve on these policies, included in liabilities, amounts to over $2,000,000)		367,294 39
*Quarterly and semi-annual premiums on existing policies, due subsequent to January 1, 1890		1,135,645 37
*Premiums on existing policies in course of transmission and collection. (The reserve on these policies, included in liabilities, is estimated at $1,700,000)		1,304,253 08
Agency balances		90,999 54
Accrued interest on investments January 1, 1890		441,344 84—$109,727,322 46
Market value of securities over cost value on Company's books		4,026,278 50

*A detailed schedule of these items will accompany the usual annual report filed with the Insurance Department of the State of New York.

TOTAL ASSETS, January 1, 1890 ..... $105,053,600 96

Appropriated as follows:

Approved losses in course of payment		$340,577 97
Reported losses awaiting proof, etc.		375,196 86
Matured endowments, due and unpaid (claims not presented)		90,502 49
Annuities due and unpaid (claims not presented)		25,588 50
Reserved for reinsurance on existing policies (Actuaries' table 4 per cent interest)		86,504,186 00
Reserved for contingent liabilities to Tontine Dividend Fund, January 1, 1890, over and above 4 per cent reserve on existing policies of that class	$6,485,777 13	
Addition to the fund during 1889	2,300,540 15	
	$8,786,317 28	
DEDUCT—		
Returned to Tontine policy-holders during the year on matured Tontines	1,019,264 28	
Balance of Tontine Fund, January 1, 1890		7,795,053 11
Reserved for premiums paid in advance		90,040 73
		$97,535,777 68
Dividible surplus (Company's new standard)		7,517,823 28
		$105,053,600 96
Surplus by the N. Y. State standard (including the Tontine Fund)		15,600,000 00

From the undivided surplus, as above, the Board of Trustees have declared a reversionary dividend to participating policies in proportion to their contribution to surplus, available on settlement of next annual premium.

Returns to Policy-holders.	*Insurance in Force.*	*Assets.*	*New Policies Issued.*
1887 ..... $9,535,219	Jan. 1, 1888 .... $[illegible]	Jan. 1, 1888 $83,079,845	1887 28,582
1888 10,575,090	Jan. 1, 1889 429,886,588	Jan. 1, 1889 [illegible]	1888 29,334
1889 12,121,121	Jan. 1, 1890 495,601,970	Jan. 1, 1890 105,053,600	1889 30,499

Number of policies issued during the year, 30,499. New insurance, $[illegible]
Total number of policies in force January 1, 1890, 750,381. Amount at risk, $495,601,970.

TRUSTEES:

WILLIAM H. APPLETON,	ALEX. STUDWELL,	WM. L. STRONG,
WILLIAM H. BEERS,	WALTER H. LEWIS,	W. F. BUCKLEY,
WILLIAM A. BOOTH,	EDWARD MARTIN,	HENRY TUCK,
HENRY BOWERS,	RICHARD MUSER,	A. H. WELCH,
JOHN CLAFLIN,	C. C. BALDWIN,	L. L. WHITE.
ROBERT B. COLLINS,	E. N. GIBBS,	
H. C. MORTIMER,	JOHN N. STEARNS,	

WILLIAM H. BEERS, President.
HENRY TUCK, Vice-President.
ARCHIBALD H. WELCH, 2d Vice-Pres.
RUFUS W. WEEKS, Actuary.
THEODORE M. BANTA, Cashier,
A. HUNTINGTON, M. D., Medical Director.

929+